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SOVIET ECONOMIC DISINTEGRATION

by
RICHARD C. HARMSTONE *

Introduction

Many factors appear to have contributed to the recent disintegration and demise of the Soviet economy (and state). In this paper I examine one factor contributing to this process, which has not generally been emphasized in Western economic literature on this subject. This factor has to do with the sharp cutbacks in the rate of growth of Soviet investment beginning in the mid-1970s.

In the 1960s and early 1970s there was increasing concern among Soviet economists and economic authorities about the inefficiencies with which the economy was operating. In the quarter century after World War II (and earlier), Soviet economic growth had depended on rapid infusions of capital, labor and other inputs, with only modest gains in productivity. As far as capital is concerned, this is suggested by the data from a Western source in Table I below. It is all but unprecedented in world economic history for the capital stock to grow more rapidly than output [1].

The shift to intensive economic growth – called for at the 24th Party Congress in 1971 – meant that in the future much more emphasis was to be placed on increases in efficiency and productivity, particularly through accelerated abandonment of existing old and obsolete assets (Val'tukh, 1970; Noren and Whitehouse, 1973, pp. 220-221). In this connection, it might be noted that official Soviet estimates put the service life of Soviet productive

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[1] This unusual feature of the Soviet economy reflected not only a high proportion of investment in national income but also an almost unprecedented reluctance to retire old and obsolete captial assets. Indeed, from 1938-1955, the very existence of obsolescence under socialism was officially denied. (ARAKELIAN, 1938, pp. 36-41 and NEKRASOV, 1955).

TABLE I *

AVERAGE ANNUAL RATES OF GROWTH, 1928-58 (in%)

Reproducible fixed capital	7.1
Net national product	4.1[a]

[a] Late year price weights
* Source is listed in Appendix

equipment in industry in 1970 at 24 years, which was roughly double the service life of comparable US assets (TSSU, 1988, p. 298; CIA and DIA, 1987, p. 3).

Two Views of the Role of Investment – Accumulators vs. Anti-accumulators

While Soviet economists were virtually unanimous about the need for a switch to intensive economic growth, there were two different versions of what this meant with respect to the rate of growth of investment. Some believed that to achieve intensive growth – particularly to accelerate replacement with improved technology – high levels of investment had to be maintained [2]. Moreover, these economists argued that high levels of investment were by no means incompatible in the long run with rising standards of living. In fact, just the opposite. High levels of investment are necessary to raise living standards significantly over longer periods of time (Val'tukh, 1970 and Sorokin, 1973). The economists in this group – who favored high levels of investment – will henceforth be referred to as "Accumulators" [3].

On the other hand, there were what henceforth will be called "Anti-accumulators", who argued for significant reductions in the rate of growth of investment and in the share of investment in national income [4].

[2] Scrappage rates are assumed to be roughly equal to replacement rates in this study. Official Soviet sources provided relatively comprehensive and systematic data on scrappage rates. Little or no systematic data on replacement rates were published.

[3] A stronghold of the latter may have been the institute of economics of the Siberian division of the USSR Academy of Sciences. The economist K. Val'tukh, who is cited frequently in what follows, was a principal spokesman for this group.

[4] A stronghold of this group appears to have been the economic research institute of the Central Planning Agency (Gosplan). The economist V. Kirichenko, who is cited frequently in what follows, was a high-level official in this institute. While initially a principal spokesman

TABLE II *
RATE OF GROWTH OF SOVIET REAL INVESTMENT AND NATIONAL INCOME (by use), 1960-1975

Years	Average annual rate of growth of capital investment (in constant rubles) (%)	Average annual rate of growth of national income (by use) (%)
1960-65	6.3	5.7
1965-70	7.6	7.1
1970-75	7.0	5.2

* Sources of data on the basis of which these percentage figures were calculated are listed in Appendix.

The Anti-accumulators, such as V. Kirichenko, a high level planning official, often couched their arguments in terms of imbalances associated with high levels of investment. Kirichenko stressed the imbalance in the economy arising from significantly higher rates of growth of capital stock than of the labor force, with a consequent underutilization of capacities. According to him, in the second half of the 1970s about a quarter of new capital assets brought on stream (by value) were underutilized (Kirichenko, 1970, 1975a, and 1980). These economists often argued that modern technology is frequently capital-saving, which should make it possible to reduce capital requirements per unit of output. Along the same lines, the Anti-accumulators pointed with envy to UN data, showing that US national income in the 1950s and 1960s rose more rapidly than capital inputs (Pervushin and Prostiakov, 1971). In this connection, it might be noted that, as shown in Table II above, based on official Soviet data, the growth of total investment in the Soviet economy generally exceeded the growth of national income.

The Anti-accumulators were at pains to show that a high rate of growth of consumer goods (Division B) as opposed to capital goods (Division A) was not incompatible with Marxist-Leninist dicta (Dovgan', 1965, pp. 68-69; Pervushin and Prostiakov, 1971; and Miroshnikov, 1972). The members of this group generally seemed to associate a cut in the rate of growth of investment with a more rapid rise in living standards (Kirichenko, 1975b, p. 2).

Finally, an important position of the Anti-accumulators was that a

for the Anti-accumulators, Kirichenko appears to have modified his views somewhat at a later date (KIRICHENKO, 1983).

cutback in investment would be accompanied by accelerated replacement, which would make it possible for the economy to realize the benefits of modern technological advances. One of the clearest explanations of this point of view was made by the planning official Kirichenko in 1980. According to him, massive new capital construction in diverse sectors of the economy reduced the availability of resources for replacement of existing capacities, thereby unduly extending the lives of the latter and rendering them hopelessly obsolete. Also, according to him, the excessive proliferation of new investment projects made it impossible to supply the material, capital and other inputs required to bring these projects on stream on schedule. This caused a lengthening of construction cycles and gestation periods (Kirichenko, 1980). Similar arguments were advanced by another official of the economic research institute of the Central Planning Agency (Gosplan), D. Chernikov (Chernikov, 1982, p. 10).

The argument seemed to assume that, with a slowing of the rate of growth of investment, imbalances and tensions allegedly created by high rates of growth of investment would be relieved and replacement almost automatically accelerated. There were no suggestions for specific measures to be taken by the government to redirect investment away from new construction or expansion to replacement, despite inbuilt biases against the latter. Specific measures to accelerate abandonment might have included such things as accelerated depreciation and special bonuses to managerial personnel who actually accelerated abandonment of obsolete assets (Kurenkov and Palterovich, 1975, p. 199; Fal'tsman, 1975, p. 194). Even more effective might have been the incorporation in annual and longer-term plans of specific replacement projects which had to be completed in order for production units to claim plan fulfillment [5].

Simplistic Interpretation of a Mathematical Formula

The automatic acceleration of replacement as a result of cutting the rate of growth of investment – postulated by the Anti-accumulators – gives rise to an intriguing speculation. According to a 1988 Soviet source, some Soviet economists – not identified by the source – argued in the 1970s, on the basis of a formula developed by a Soviet scholar, Ia. B. Kvasha, that higher rates of retirement are associated with lower rates of growth of

[5] A measure similar to this was incorporated in the 12th five-year plan (1986-90), with initially favorable results (ZHURALEV, 1988; TSYGICHKO, 1987).

investment and capital stock and lower rates of retirement are associated with higher rates of growth of investment and capital stock (Sychev, Ozhegov and Borisov, 1988, p. 23) [6]. A common version of the formula is as follows (Kvasha, 1979, p. 35):

$$K_v = \frac{r}{(1 + r)^t - 1}$$

where K_v = the rate of retirement (the ratio of abandoned assets to capital stock), r = the rate of growth of investment (or capital stock) and t = the average service life of the capital stock.

Before proceeding further, a few historical and other details concerning this formula should perhaps be pointed up. The formula appears to have been developed by Kvasha in a work published in 1937 (Kvasha, 1937, p. 172) [7]. The Kvasha formula can be readily derived from certain of Domar's calculations (Domar, 1957, p. 157, n. 8 nd p. 161). Soviet sources accordingly sometimes referred to this mathematical expression as the Kvasha-Domar formula (Sychev, Ozhegov and Borisov, 1988, p. 20). Finally, it should be noted that the Kvasha formula is identical with what is known in Western finance as the "sinking fund factor" (Grant and Ireson, 1960, p. 553).

The interpretation of the Kvasha (or Kvasha-Domar) formula by the Soviet economists alluded to in the aforementioned 1988 monograph would be correct if – and this is a big if – the average service life of the capital stock were constant and independent of the rate of growth of investment. This can be easily verified by reference to the sinking-fund-factor in any set of compound interest tables. If, for example, r in the Kvasha formula goes from 5% to 10% and the average service life (t) remains at 12 years, the retirement ratio (K_v) will go from .063 to .047 – a decline of 25% (Grant and Ireson, 1960, pp. 548-553).

In fact, however, the average service life of the capital stock may not be independent of the rate of growth of investment (and capital stock). If

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[6] Since the central planning agency (Gosplan) appears to have been an Anti-accumulator stronghold, it is possible that the economists alluded to here may have worked for this agency.

[7] In the 1937 Kvasha work, the mathematical formula appears to be misstated, possibly as a result of a typographical error, as

$$\frac{r)}{(1 + r)^{-\cdot t}}$$

In a 1959 Kvasha work the formula presented is very close to that in the 1979 Kvasha monograph cited above (KVASHA, 1959, p. 97).

the rate of growth of investment (and capital stock) slacks off – and the availability of resources for replacement is thereby reduced, the average service life of the capital stock may increase and the ratio of replacement to stock may decline rather than increase [8]. Conversely, if the rate of growth of investment (and capital stock) rises and the availabilty of resources for replacement is thereby increased, the average service life of the capital stock may decrease and the ratio of replacement to stock may rise rather than decline [9]. Thus it is possible that a simplistic interpretation of the Kvasha formula could have contributed to the development of the Anti-accumulator point of view – that a reduction in the rate of growth of investment would automatically accelerate the pace of replacement.

Leadership's Adoption of the Anti-accumulator View

In the mid-1970s, the Soviet government adopted the views of the Anti-accumulators, cutting the rate of growth of investment sharply (Tables III and IV below) [10]. Some authoritative Soviet and Western economists believe the rates of growth of investment from 1975-1985, in both Tables III and IV below, overstate the actual rate, which, during at least part of this period, may have been negative (Val'tukh, 1982; Nove, 1987; and Bergson, 1987).

Such cuts must have appeared particularly attractive to the leadership. This was a period when the USSR was pursuing an adventurous, expansionary foreign policy abroad, buttressed by rough strategic balance with the US, while simultaneously seeking to raise living standards at home. Resources required to accomplish these diverse purposes were very scarce indeed (Rush, 1982, pp. 329-330; Thomas, 1979, p. 74; Aganbegian, 1985; and Sorokin, 1987).

While political and strategic considerations undoubtedly played a predominant role in the decision to sharply cut back the rate of growth of investment, at least one other possible motivating factor should be mentioned. As indicated earlier, Soviet economists and economic authorities were envious of the fact that in Western countries, such as the US, national

[8] To anticipate future results, this appears to have been precisely what happened in the USSR in the second half of the 1970s and the first half of the 1980s.

[9] The average service life of the capital stock, it might be noted, is influenced not only by factors on the supply side, such as the availability of capital for replacement. Demand factors may also play a crucial role.

[10] Table III is based on a Western source and Table IV is based on Soviet sources.

TABLE III *

AVERAGE ANNUAL% GROWTH OF NEW FIXED INVESTMENT IN ALL SECTORS OF THE ECONOMY (BASED ON FIGURES IN BILLIONS OF 1970 RUBLES)

	1960-65	1965-70	1970-75	1975-80
Total	6.4	6.8	6.2	3.4
Machinery and equipment	10.2	7.5	8.8	6.5
Construction and other capital outlays	5.0	6.4	5.1	1.7

* Source of data on the basis of which these calculations were made is listed in Appendix.

TABLE IV *

AVERAGE ANNUAL % GROWTH OF INVESTMENT IN ALL SECTORS OF THE ECONOMY AND INDUSTRY (BASED ON RUBLE FIGURES ADJUSTED FOR PRICE CHANGES)

	1960-65	1965-70	1970-75	1975-80	1980-85
All sectors	6.0	7.5	7.0	3.4	3.5
Productive	7.4	7.6	8.0	3.5	3.2
Non-productive (includes investment in housing, health care and the like)	3.7	7.4	4.1	2.5	4.0
Industry	6.5	6.6	6.7	3.5	4.2

* Source of data on basis of which these calculations were made is listed in Appendix.

income was increasing more rapidly than investment, reflecting greater efficiency in the use of capital in these countries. The sharp reductions in the rate of growth of investment – described by Kirichenko as a kind of strategic "maneuver" – appear to have been designed in part to force Soviet industrial ministries and the production and construction units under their jurisdiction to operate more efficiently – in particular, to meet output targets without the customary excessive reliance on increased capital inputs (Kirichenko, 1983; Ivanov, 1991). In the absence of disciplinary market mechanisms – including an effective interest charge – such coercion may have appeared to be one of the few means available to encourage economy in the use of capital inputs (Senchagov, 1974, pp. 163-164; Nove, 1972, p. 233; and Gregory and Stuart, 1989, p. 200).

Assessment of the Anti-accumulator Views

Before examining the consequences of these dramatic changes in Soviet investment policy, based to a considerable extent on the views of the Anti-accumulators, it is worth pausing a moment to assess the rationality of these views. In such an assessment, it is useful to keep in mind that the USSR was faced with a relatively severe, intensifying labor shortage in the mid-1970s and 1980s (Table V below).

TABLE V *

AVERAGE ANNUAL RATES OF GROWTH OF LABOR FORCE IN SOVIET ECONOMY AS A WHOLE AND IN INDUSTRY (%)

	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90
In economy as a whole	4.4	2.1	2.5	1.9	1.0	.2
In industry	4.0	2.9	1.5	1.6	.7	−1.6

* Sources of data are listed in Appendix.

The views of the Anti-accumulators appear, to this observer, to have been extremely naive and ill-founded. It was a mistake to attribute some of the principal ills of the capital goods sector of the Soviet economy in the mid-1970s – long construction cycles, dissipation of investment resources over an excessively large number of projects, high levels of unfinished construction, extraordinarily retarded replacement and the like – to high levels of investment. The tensions and inefficiencies of the economy, in my opinion, were rooted in excessively centralized, taut economic planning – with very ambitious output targets – and the absence of disciplinary market mechanisms.

Rather than sharp reductions in the rate of growth of investment, the economy sorely needed a redirection of investment – away from new construction and expansion projects to replacement and mechanization [11]. Large

[11] In a 1979 article, it might be noted, Abram Bergson concluded that the USSR was not oversaving (and hence overinvesting) as judged by Golden Rule growth requirements (BERGSON, 1979, p. 219).

Some Western analysts believed that to substitute capital for labor the level of investment would have had to be increased, with the risk of diminishing returns (COHN, 1979, p. 232). However, with a significant redirection of investment toward replacement and mechanization, capital could have been substituted for labor without increased levels of investment and the

amounts of labor were tied up in repair activities because of the extraordinarily long service lives of Soviet fixed assets. In the early 1970s these activities reportedly engaged a tenth of the industrial labor force and a third of the contry's stock of metal-cutting tools (Schneiderov, 1975). More than half of Soviet industrial workers were classified as unskilled, making use of little or very unsophisticated equipment (Cohn, 1979, p. 235).

Such a redirection of Soviet investment could only be made more difficult by significant reductions in the rate of growth of investment. Such cuts would reduce the availability of capital assets which could be used for replacement and mechanization. They would almost certainly increase the scarcity of capital relative to other resources. Throughout Soviet economic history prior to 1975, greater capital scarcity was associated with slower rather than more rapid replacement (Harmstone, 1988) [12].

Even had the rate of growth of investment, however, been maintained – rather than sharply curtailed – this in itself would, in all probability, not have been sufficient to assure levels of replacement and mechanization of the required magnitudes. Given the Soviet bias against replacement, for example, specific governmental measures aimed at accelerating this activity would have undoubtedly been required.

One final point should be made regarding the views of the Anti-accumulators. It is axiomatic in Western economic thought that any gain in consumption, as a result of a cut in investment, will be very short-lived. In the long run, consumption will be lower than it would have been had investment not been cut. Put it in another way, the adverse effect on consumption now of a larger share of investment in national income will be more than offset in the long run by a more rapid growth in the overall economy (Samuelson and Nordhaus, 1989, pp. 31-32 and p. 51). This truth seems to have been well understood by the Accumulators but, as suggested earlier, largely ignored by the Anti-accumulators (Val'tukh, 1970).

Effects on Economy of Sharp Cuts in Investment Growth

As indicated in Table VI below, the sharp cuts in the rate of growth of

attendant risk of diminishing returns. This would have been particularly the case had the assets used for replacement been technologically improved relative to the assets being replaced.

[12] A general consensus appears to have developed in Western countries that the pace of replacement will vary inversely with the degree of capital scarcity – the greater the degree of scarcity, the slower the pace of abandonment and vice versa (SALTER, 1960, pp. 44-47). It is of some interest that this inverse relationship seemed to hold in a nonmarket economy such as that of the former USSR.

TABLE VI *

AVERAGE ANNUAL RATES OF GROWTH OF NATIONAL INCOME, INDUSTRIAL PRODUCTION, AND CRUDE STEEL OUTPUT 1965-1985 (IN PERCENT)

	1965-70	1970-75	1975-80	1980-85
National income[a] (by use)	7.1.	5.2	3.8	2.8
Industrial production [a]	8.4	7.5	4.5	3.7
Crude steel output[b]	4.9	4.1	0.9	0.9

[a] All percentage figures, as far as is known, were calculated on the basis of what was called data in comparable (constant) prices in the former USSR.

[b] Calculated on the basis of data in millions of metric tons.

* Sources of data on the basis of which these percentage figures were calculated are listed in Appendix.

investment – in line with the views of the Anti-accumulators – were accompanied by severe reductions in the rate of growth of important economic variables, including national income and industrial production. Calculations by an authoritative Soviet source point to a precipitous drop in the rate of growth of real, per capita income over the period 1975-1985. According to these calculations, this rate fell from 24% in the period 1971-75 to 18% in 1976-80 to just 11% in the 1981-85 period (Ivanov, 1991).

The pace of abandonment similarly fell off (Table VII below). The decline in the retirement ratio was particularly marked in the case of buildings and structures, presumably reflecting the steep reduction in construction outlays (Table III above). The Kvasha formula suggests that if both the

TABLE VII *

SIMPLE AVERAGE OF INDUSTRIAL RETIREMENT RATIOS (% OF CAPITAL STOCK)[a]

Years	Total productive fixed assets	Machinery and equipment	Buildings and structures
1971-75	1.8	2.5	1.0
1976-80	1.4	2.4	.6
1981-85	1.3	2.3	.4

[a] Ratios from 1973 on are computed on the basis of beginning-of-year stock. It is not clear whether the 1971 and 1972 ratios were calculated on the basis of beginning-of-year stock or on some other basis (average annual capital stock, for example).

* Sources of ratios are listed in Appendix.

scrappage rate and the rate of growth of investment (and capital stock) decline, as they did in the USSR in the 1970s and 1980s, the average service life of the capital stock must increase. This appears to have been precisely what happened in the USSR in the 1970s and 1980s. According to official Soviet statistics, the average service life of Soviet machinery and equipment in industry increased from 24.0 years in 1970 to 27.9 in 1985, an increase of about 16% (TSSU, 1988, p. 298) [13]. Given the steep decline in the scrappage ratio for buildings and structures, the increase in the average service life of these assets must have been much more significant [14].

Early Gorbachev Period

Because of the poor performance of the Soviet economy over the period 1975-85, the Soviet leader Gorbachev, who came to power in 1985, launched his now famous reforms. He began by espousing the views of the Accumulators. He described the cutback in investment from one five-year plan to another as "completely unjustified". In line with this view, the 12th five-year plan (1986-90) called for a 23 percent rise in investment in the economy as a whole, which compares with a 15 percent realized increase in the 1981-85 period (*Pravda*, 1986, p. 2).

A glance at Table VIII below shows that the rate of growth of investment did, in fact, rise sharply in the period 1985-88. The economy appeared to respond favorably to the increase in the rate of growth of

TABLE VIII *

AVERAGE ANNUAL % GROWTH OF INVESTMENT IN ALL SECTORS OF THE ECONOMY AND INDUSTRY (BASED ON RUBLE FIGURES REPORTEDLY ADJUSTED FOR PRICE CHANGES) 1980-1990

	1980-85	1985-88	1988-90
All sectors	3.5	6.7	2.6
Productive	3.2	5.9	1.9
Non-productive	4.0	7.4	4.7
Industry	4.2	6.7	–.4

* Sources of data are listed in Appendix.

[13] The methodology used to derive these estimates is not clearly spelled out by the source.

[14] No official estimates of the service life of this category of assets are available.

investment. As indicated in Table IX below, the rate of retirement of productive fixed assets in industry rose steeply [15]. According to an official estimate, the average service life of equipment in industry fell from 27.9 years in 1985 to 26.3 years in 1988 (TSSU, 1988, p. 298). As indicated in Table X, the rate of growth of industrial production held its own during this period, though this rate and the rate of growth of national income may have been significantly constrained by special factors. The latter included the short-term disruptive effects of an increased official emphasis on product

TABLE IX *

SIMPLE AVERAGE OF INDUSTRIAL RETIREMENT RATIOS (% OF BEGINNING-OF-YEAR CAPITAL STOCK) 1981-1990

Years	Total productive fixed assets	Machinery and equipment	Buildings and structures
1981-85	1.3	2.3	.4
1986-88	1.9	3.2	.8
1989-90	1.6	2.6	.7[a]

[a] Estimate based on relationship of scrappage of buildings and structures to total industrial scrappage in the period 1986-88.

* Sources of data are listed in Appendix.

TABLE X *

AVERAGE ANNUAL RATES OF GROWTH OF NATIONAL INCOME, INDUSTRIAL PRODUCTION, AND CRUDE STEEL OUTPUT 1980-1990 (IN PERCENT)

	1980-85	1985-88	1988-90
National income[a] (by use)	2.8	2.3	.8
Industrial production[a]	3.7	4.0	.3
Crude steel output[b]	0.9	1.7	(–) .3

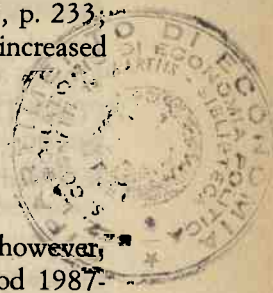
[a] All percentage figures as far as is known, calculated on the basis of what were called data in comparable (constant) prices in the former USSR.

[b] Calculated on the basis of data in millions of metric tons.

* Sources of data on the basis of which these percentage figures were calculated are listed in Appendix.

[15] In this connection, see also n. 5 above.

quality improvement and an anti-alcohol campaign (Gregory, 1987, p. 233; Treml, 1987, p. 304) [16]. Real per capita income appears to have increased over at least part of this period (Ivanov, 1991).



Late Gorbachev Era

The apparent political ascendancy of the Accumulators was, however, short-lived. Gorbachev appears to have succumbed, over the period 1987-88, to the deceptively simple, politically seductive arguments of the Anti-accumulators (Kirichenko and Uvarov, 1987; Kirichenko and Uvarov, 1988). This was part of a more general shift of his position away from what might be called the traditional Soviet growth model (Ellman and Kontorovich, 1992, pp. 15-16). The latter included heavy reliance on high levels of investment, ministerial prodding and pressure on managers of productive units for greater efficiency and strict labor discipline. Efforts to graft disciplinary market mechanisms on the command system were generally very muted indeed.

In line with the above shift in Gorbachev's position, the government reassessed and sharply revised its economic policies. This change in course involved the redirection of investment away from productive projects provided for in the 12th five-year plan (1986-90) to nonproductive projects of a social overhead character – including housing – not provided for in the 12th five-year plan. Investment was also reallocated away from heavy industry and the defense sector to consumer oriented industries. This redirection of investment in some cases involved the mothballing of expensive productive projects, thereby seriously disrupting supply relationships (Kirichenko and Uvarov, 1988; Loginov, Maevskii and Mozhaiskova, 1988). Adverse ripple effects spread throughout the economy which, in the final analysis, was still based primarily on crude input-output concepts and mechanisms. Supply problems were further compounded in 1989 and 1990 by strikes, by enterprises asserting their new rights and refusing to fulfill contractual obligations and by burgeoning nationality conflicts (Plyshevskii, 1990).

The upshot of all this was a sharp decline in the rate of growth of investment and a faltering of the economy in general. The rate of growth of

[16] Other observers have commented on the generally favorable developments in the Soviet economy during the initial years of the Gorbachev era (ELLMAN and KONTOROVICH, 1992, p. 15).

investment in industry was actually negative from 1988 to 1990 and the rate of growth of industrial output during this period was a negligible .3% (Tables VIII and X). Industrial scrappage rates also fell during this period (Table IX). As is well known, the USSR ceased to exist as a unified whole in 1991, splintering into 15 independent states. The economy, of course, followed suit.

Summary and Postscript

In sum, the beginning of the end of the Soviet economy may have occurred in the mid-1970s as the rate of growth of investment was sharply curtailed in the midst of a mounting, relatively severe labor shortage. Instead of utilizing capital to take the sting out of the mounting labor shortage through accelerated replacement and mechanization, the government aggravated the problems associated with this shortage by cutting back sharply on the rate of growth of investment. A seductive notion that the economy would function more efficiently with a lower rate of growth of investment was accepted by the Brezhnev leadership. The latter was hard-pressed to find the resources required to maintain strategic parity with the US and to raise living standards. It is possible that a simplistic interpretation of a mathematical formula contributed to the decision to sharply curtail investment.

This policy was reversed in the early years of the Gorbachev regime, with moderately favorable economic results. In 1988, however, Gorbachev seemed to revert to the short-sighted Brezhnev policy of seeking to raise living standards now at the expense of investment – with the well-known adverse, if not catastrophic, effects on the economy.

So much for one aspect of the disintegration and eventual demise of the Soviet economy. Some other aspects of Soviet experience in the period 1975-90 perhaps deserve at least brief summary comment. The close inverse relationship between changes in capital scarcity and replacement during this period is striking. The sharp cuts in the rate of growth of investment in the late 1970s and early 1980s – almost certainly increasing capital scarcity – were accompanied by significant declines in the scrappage rate. The brief recovery in the rate of growth of investment in the period 1985-88 – when Gorbachev appeared to be under the influence of the Accumulators – was accompanied by a rise in the rate of abandonment. In the period 1988-90 – when Gorbachev seems to have fallen under the influence of the Anti-accumulators – the rate of growth of investment and the scrappage rate fell

significantly. According to official data, the rate of growth of investment in industry actually turned negative during this period.

When, as in the USSR in the 1970s and 1980s, both the rate of growth of investment and national income fell sharply, it is difficult to disentangle cause and effect relationships. Did the fall in national income cause the decline in investment or the other way around? In the USSR in the mid-1970s the initial causal factor appears to have been the deliberate government decision to sharply curtail the rate of growth of investment. When the rate of growth of national income began to fall, as a result of this decision, this decline may well have reinforced the tendency for the rate of growth of investment to fall. In other words, a kind of mutually reinforcing the vicious cycle of declines in investment and national income was set in motion.

A considerable literature on cyclical fluctuations in centrally planned economies has emerged (Ickes, 1986). It is possible that the jockeying of the Accumulators and Anti-accumulators for political influence contributed to the appearance of such fluctuations in the USSR.

Finally, Soviet experience in the 1975-85 period suggests that caution should be exercised in interpreting what Soviet economists called the Kvasha-Domar formula or some closely related mathematical expression (Maddison, 1964, p. 85). The formula suggests that, assuming the average service life of capital assets is unaffected, the ratio of replacement to capital stock will rise if the rate of growth of investment falls and vice versa. Soviet experience in the late 1970s and early 1980s suggests, however, that the assumption that the average service life of the capital stock will remain constant under these conditions may not hold. The slower rate of growth of investment will reduce the availability of resources for replacement and the ratio of replacement to stock, rather than rising, may decline. Any tendency for the ratio of replacement to capital stock to rise may be offset by a lengthening in the average service life of the capital stock. Similarly, an increase in the rate of growth of investment, rather than bringing about a decline in the ratio of replacement to stock, may actually raise it. Any tendency for this ratio to fall may be offset by a shortening in the average service life of the capital stock. Because of variability in the average service life of capital assets, predictions about the effect on the ratio of replacement to stock of variations in the rate of growth of investment must, as some of the Soviet Anti-accumulators undoubtedly discovered, be highly tentative.

APPENDIX

Sources of Data Presented in Tables

TABLE I

Source is Campbell, 1991, p. 128.

TABLE II

Source of investment data for 1960-65 is TSSU, 1965, p. 528; for 1965-70, TSSU, 1975, p. 513 and for 1970-75, TSSU, 1980, p. 335. Source of national income data (by use) for 1965-70, is TSSU, 1975, p. 49 and for 1970-75, TSSU, 1980, p. 39.

TABLE III

Percentage figures calculated from data in Pitzer, 1982, pp. 66-67.

TABLE IV

Percentage figures calculated from data in TSSU (Goskomstat), 1987, pp. 293-295.

TABLE V

Percentage figures on labor force growth calculated from data in TSSU, 1965, pp. 56 and 140; TSSU, 1975, pp. 48 and 210; TSSU, 1982, pp. 61 and 162; TSSU (Goskomstat), 1988, pp. 37 and 107 and TSSU (Goskomstat), 1990, pp. 8 and 386.

TABLE VI

Source of national income (by use) data for 1965-70 is TSSU, 1975, p. 49; for 1970-80, TSSU, 1980, p. 39 and for 1980-85, TSSU, 1988, p. 16. Source of industrial production data for 1965-80 is TSSU, 1980, p. 39 and for 1980-85, TSSU, 1988, p. 5. Source of crude steel production data for 1965-80 is TSSU, 1980, p. 158 and for 1980-85, TSSU (Goskomstat), 1988, p. 382.

TABLE VII

Source of 1971 and 1972 data is Kurenkov and Palterovich, 1975, p. 42. Source of data from 1973-85 is successive issues of the Soviet statistical yearbook (*Narodnoe Khozaistvo SSSR*), published by TSSU (Tsentral'noe statisticheskoe upravlenie). 1973 figure from TSSU, 1973, p. 241; 1974 figure, TSSU, 1974, p. 205; 1975: TSSU, 1975, p. 225; 1976: TSSU, 1976, p. 190; 1977: TSSU, 1977, p. 137; 1978: TSSU, 1978, p. 133; 1979: TSSU, 1979, p. 159; 1980: TSSU, 1980, p. 147; 1981: TSSU, 1981, p. 175; 1982: TSSU, 1982, p. 136; 1983: TSSU, 1983, p. 145; 1984: TSSU, 1984, p. 157 and 1985: TSSU, 1985, p. 124.

TABLE VIII

Source of data for 1980-85 is TSSU (Goskomstat), 1987, pp. 293-295; for 1985-88, TSSU (Goskomstat), 1988, pp. 553-554 and for 1988-90, TSSU (Goskomstat), 1990, pp. 546 and 551.

TABLE IX

Source of data for 1981 is TSSU, 1981, p. 175; 1982: TSSU, 1982, p. 136; 1983: TSSU, 1983, p. 145; 1984: TSSU, 1984, p. 157; 1985: TSSU, 1985, p. 124; 1986: TSSU (Goskomstat), 1986, p. 151; 1987: TSSU (Goskomstat), 1987, p. 108; 1988: TSSU (Goskomstat), 1988, p. 361; 1989: TSSU (Goskomstat), 1989, p. 358 and 1990: TSSU (Goskomstat), 1990, p. 380.

TABLE X

Source of national income (by use) data for 1980-88 is TSSU (Goskomstat), 1988, p. 16 and for 1988-90, TSSU (Goskomstat), 1990, p. 13. Source of industrial production data for 1980-88 is TSSU (Goskomstat), 1988, p. 5 and for 1988-90, TSSU (Goskomstat), 1990, p. 5. Source of crude steel production data for 1980-88 is TSSU (Goskomstat), 1988, p. 382 and for 1988-90, TSSU (Goskomstat), 1990, p. 398.

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LA DISINTEGRAZIONE ECONOMICA SOVIETICA

Molti fattori hanno indubbiamente contribuito alla recente disintegrazione e crollo dell'economia sovietica. Questo articolo si concentra su un fattore: i drastici tagli negli investimenti a partire dalla metà degli anni settanta. Si sostiene che questi tagli hanno esacerbato problemi già esistenti connessi a una crescente e abbastanza grave scarsità di lavoro. Viene qui ipotizzato che una semplicistica interpretazione di una formula matematica sviluppata da uno studioso sovietico può aver contribuito alla decisione di ridurre drasticamente gli investimenti. Ad ogni modo, si mostra che la fine dell'economia sovietica può essere iniziata sin dalla metà degli anni settanta quando si ebbe il brusco calo della spesa per investimenti.

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MONOPSONY AND THE PROPERLY DEVISED MINIMUM WAGE: A REEXAMINATION

by
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1. *Introduction*

The effects of a minimum wage, enacted by either legislation or a monopoly union, on a monopsony employer are illustrated in many papers and textbooks [1]. It is generally accepted that a properly devised minimum wage can increase both wages and employment by the firm. However, very little theoretical research has appeared that illustrates the effects of a minimum wage on industry wide employment when each firm in the industry enjoys monopsony power, but sells its product in a competitive market.

The traditional analysis of monopsony employment by the firm assumes that the firm is the sole employer of labor, yet it sells its product in a purely competitive market. The classic example of monopsony is a firm, such as a coal mining company or a textile mill, that establishes a plant in a remote or isolated area where the costs of labor transportation are high. Under these circumstances, the firm enjoys monopsony rents and pays a wage that is less than the marginal revenue product of labor. It is assumed that no new firms enter the area to compete for the relatively low cost labor and that monopsony rents are not transferred to the land owners.

Given these conditions a properly devised minimum wage, i.e. a minimum wage that forces the employer to pay a wage equal to the marginal revenue product of labor, will increase employment by the firm. The increase in employment however is subject to the condition of non-negative profits. If monopsony rents are necessary for the survival of the firm, then a

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[1] See for example BLOOM (1941), MAURICE (1974), MARSHALL and BRIGGS (1989), MCCONNELL and BRUE (1992), or WACHTEL (1992).

minimum wage will result in no employment at all due to the failure of the firm.

The traditional analysis requires that the monopsony firm be viewed in one of two ways: either the monopsony firm is unique in its competitive product industry and no other firms enjoy monopsony power, or the monopsony firm is also a monopolist in its product market. In the former (and most often cited) case, enacting a minimum wage on the monopsony firm has no effect on the product price, since a single firm is affected, also the effect on employment in the industry is negligible and is exclusive to the single monopsony firm. The traditional analysis fails to consider an alternative view of monopsony – a competitive product industry in which many or all firms in the industry have some monopsony power in their individual labor markets. This view of monopsony, which has been mentioned by Robinson (1969) and Call and Holahan (1983), may more accurately depict the market circumstances that exist in the textile, coal, steel, automotive, or other industries. The more traditional view of monopsony and the properly devised minimum wage fails to analyze the impact of a minimum wage on industry wide employment.

The lack of theoretical analysis in this general area may be due to the fact that some economists believe that there is very little monopsony power in labor markets, especially since the company town and labor immobility seem to be things of the past. However, recent work has pointed to monopsony power in some markets such as professional sports and nursing [2]. Furthermore, if one chose to take an extreme view one could say that monopsony power exists in any market where wages are determined by bargaining between an employer (or an association of employers) and union leaders. After all, wage bargaining necessarily implies that neither the employers nor the employees are wage takers and that bilateral monopoly exists to some degree.

Given that some monopsony power may exist, it is important to determine under what conditions a legislated or union imposed minimum wage will increase or decrease industry wide employment when firms in the industry sell their product in competitive markets. It is clear that a minimum wage will increase the cost of production for firms in an industry and that a zero profits equilibrium before and after the minimum wage imposition requires that some firms fail. As Joan Robinson pointed out, when the level of employment per firm rises and the number of firms in an industry

[2] See LINK and LANDON (1975) and SCULLY (1974).

decreases due to a minimum wage, the net effect on industry wide employment is difficult to determine. She suggests (1969, p. 299):

> ... unless the physical productivity of labor is much reduced, the amount of employment at the higher wage will be less than at the lower wage. It is therefore only in the unlikely case where physical productivity falls to a sufficient extent to compensate for the reduction in output that it is possible to impose a minimum wage without causing unemployment... [3].

Attempts to quantify the effects of a minimum wage on industry employment when firms have monopsony power have failed to appear. However, a series of articles in the *American Economist* attempts to refute and/or support Mrs. Robinson's position through graphical analysis [4]. In one of these articles, Gramm and Ekelund (1968, p. 80) suggest:

> Whether a minimum wage raises or lowers industry employment depends on the relative strengths of the production and factor substitution effects. These effects in turn depend on the elasticity of demand for output, the marginal rate of technical substitution between labor and capital, and the ratios of the marginal factor costs of labor and capital, respectively. Parameters must be specified before the effects of the establishment of a minimum wage in a monopsonistic industry can be assessed and made determinant.

Also, Milton Friedman recognized the nature and complexities of the properly devised minimum wage, but rather than pursuing a theoretical framework of monopsony and the minimum wage he admonishes the use of (federally imposed) minimum wage as a policy tool with the following statement (1976, p. 193):

> It is perhaps worth noting explicitly that this case is little more than a theoretical curiosum and cannot be regarded as of any great practical importance. This is partly because significant degrees of monopsony are particularly unlikely to occur for factors of the kind affected by minimum wages rates, ...

Professor Friedman's view of a national minimum wage policy on unskilled labor is understandable since monopsony is not prevalent in that market and a properly devised minimum wages is difficult to institute. However, brushing aside the whole theory of the impact of minimum wages on monopsony employment is unadvisable. The impact of a legislated mini-

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[3] CALL and HOLAHAN (1983) also suggest that the change in industrial unemployment after a minimum wage is indeterminate under similar conditions.

[4] See FALERO (1966), GRAMM and EKELUND (1968), and YATES and TAYLOR (1967).

mum wage on monopsony is identical to a union imposed wage standard. From this standpoint, a cogent analysis of minimum wages, monopsony, and industrial employment is long overdue.

Robinson (1969), Call and Holahan (1983), and Gramm and Ekelund (1968) all suggest that the effect on industry employment is indeterminate. Robinson suggests that the change in employment depends upon the marginal product of labor while Gramm and Ekelund suggest that it depends upon the elasticity of product demand and factor substitution effects. However, neither provides a rigorous analysis of industrial employment nor do they suggest that elasticity of labor supply has any influence on employment. Given the potential impact of union or state imposed wage policies on industrial employment, it is imperative that a trenchant theoretical examination be undertaken.

In an effort to determine the effects of a minimum wage in a competitive industry filled with monopsonistic firms, a model that includes elasticity of product demand, elasticity of marginal revenue product [5], and elasticity of labor supply should yield greater insight than any found in the literature to date. The model that follows incorporates these concepts.

2. *The Model*

Consider an industry in which all firms are identical and each firm is located in its own isolated area. The supply of labor to each firm is upward sloping and the same for each firm in each location. New firms may enter the industry at new isolated locations and achieve the same monopsony power as all existing firms. This assumes that no two firms' labor market areas overlap so that the demand for labor at any location does not increase as new firms enter.

Under these circumstances, if the price of nonlabor resources is constant, then the industry is subject to constant cost in spite of the fact that the supply of labor is upward sloping to each firm. Any number of firms may enter the industry with no change in the average cost curve for any firm since the cost conditions and labor supply for each firm may be duplicated for an undefined number of locations. Further, if the total cost of transporting the product to market is zero or identical for all firms, then a zero profits competitive equilibrium will be achieved. If profits exist, product

[5] Since monopsonists do not have labor demand curves, the elasticity of marginal product is used here as a substitute for the concept of labor demand elasticity.

price will fall, as the result of entry, until all firms break even regardless of the monopsony power of each firm.

Let each firm's production function take the following form:

$$(1) \qquad q = \frac{1}{\alpha + 1} L^{\alpha + 1} \qquad \text{for} \qquad (-1 < \alpha < 0)$$

where q is the firm's output, L is the level of employment, and α is constant. This production function is a modification of the Cobb-Douglas form with labor as the only variable input [6]. Marginal product is:

$$(2) \qquad MP = \frac{dq}{dL} = L^{\alpha} \qquad \text{where} \qquad \frac{dMP}{dL} = \alpha L^{\alpha - 1} < 0$$

Since α is a negative fraction, diminishing returns exist at all levels of employment. This particular functional form results in a constant elasticity of marginal product equal to:

$$(3) \qquad E_M = \frac{MP}{L} \frac{dL}{dMP} = \frac{1}{\alpha}$$

Let the supply of labor to each firm be upward sloping and take the form:

$$(4) \qquad W = L^{\beta} \qquad \text{where} \qquad 0 < \beta < \infty$$

With W equal to the wage, the elasticity of labor supply, E_L, is constant for any value of β and equal to $1/\beta$. Total labor cost is the wage rate times the level of employment:

$$(5) \qquad TLC = WL = L^{\beta + 1}$$

It follows that marginal labor cost to the firm is:

$$(6) \qquad MLC = (\beta + 1) L^{\beta}$$

All nonlabor costs are fixed and equal to F. Total costs are, therefore, labor cost plus fixed cost:

$$(7) \qquad TC = L^{\beta + 1} + F$$

[6] Although this is a short-run production function, the essential differences between the short and long run can be captured in the value of α, i.e., the value of α can be lower in the long run than in the short run if one suspects that capital substitution may occur. Also, it is impossible to derive a firm's long-run demand for labor if it sells its product in a competitive market.

Let industry demand for the product also have constant elasticity (ε) and take the form:

$$Q = P^{\varepsilon} \tag{8}$$

where Q is industry output and P is product price. This allows for a downward sloping demand curve with any desired elasticity.

3. *Monopsony*

Under these circumstances the zero profits equilibrium level of employment with no minimum wage can easily be determined. The fixed costs and rising marginal cost result in the typical U-shaped average total cost curve (ATC_M) as illustrated in Figure 2. Since the costs of production are identical at each of the separate locations and for any number of firms, the industry supply is subject to constant cost. As firms enter or leave the industry, the labor supply for each firm does not change. Consequently, industry supply is infinitely elastic at the price that coincides with the firm's minimum average cost as shown in Figure 1. Equating marginal cost and

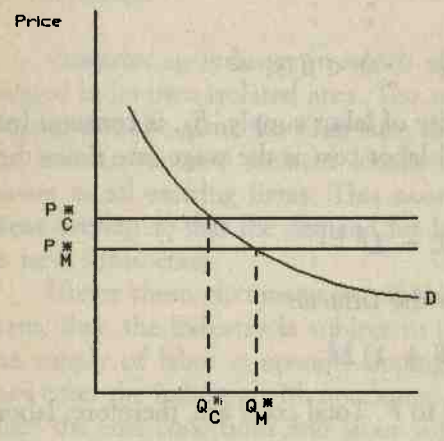

FIGURE 1

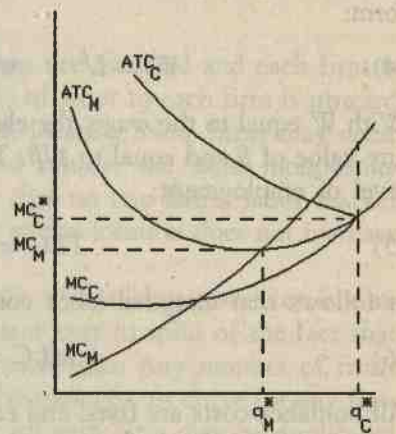

FIGURE 2

average cost as functions of labor yields the equilibrium level of employment per firm. In the monopsony case, the marginal cost of production is equal to marginal labor cost (6) divided by marginal product (2):

$$MC_M = \frac{MLC}{MP} = \frac{(\beta + 1)\, L^{\beta}}{L^{\alpha}} = (\beta + 1)\, L^{\beta - \alpha} \tag{9}$$

Average cost is total cost (7) divided by the firm's output (1):

$$(10) \quad ATC = \frac{TC}{q} = \frac{L^{\beta+1} + F}{\frac{1}{\alpha+1} L^{\alpha+1}} = (\alpha + 1)(L^{\beta+1} + F) L^{-\alpha-1}$$

The zero profits equilibrium output for the firm occurs where $MC = ATC$. Since MC and ATC are functions of L, the equilibrium level of employment, L_M^* may be found by equating (9) and (10).

$$(11) \quad (\beta + 1) L^{\beta-\alpha} = (\alpha + 1)(L^{\beta+1} + F) L^{-\alpha-1}$$

$$(12) \quad L_M^* = [(\alpha + 1) F/(\beta - \alpha)]^{1/(\beta+1)}$$

After determining the level of employment per firm, the industry wide level of employment can be found by multiplying L_M^* times the number of firms in the industry. The number of firms in the industry is equal to industry output divided by output per firm since all firms are identical. Substituting L_M^* from (12) into the firm's production function (1) yields q_M^* the equilibrium output per firm:

$$(13) \quad q_M^* = \frac{1}{\alpha+1} [(\alpha + 1) F/(\beta - \alpha)]^{\frac{\alpha+1}{\beta+1}}$$

The industry output can be found by substituting either equilibrium marginal costs or average cost for price in the industry demand equation. Substituting L_M^* into the marginal cost function (9) yields the equilibrium price:

$$(14) \quad MC_M^* = (\beta + 1) [(\alpha + 1) F/(\beta - \alpha)]^{\frac{\beta-\alpha}{\beta+1}}$$

Substituting (14) for price in the industry demand equation yields the equilibrium industry output:

$$(15) \quad Q_M^* = (\beta + 1)^{\varepsilon} [(\alpha + 1) F/(\beta - \alpha)]^{\frac{\varepsilon\beta-\varepsilon\alpha}{\beta+1}}$$

The equilibrium number of firms in the industry, N_M^*, is equal to Q_M^* divided by q_M^*, or

$$(16) \quad N_M^* = \frac{Q_M^*}{q_M^*} = (\alpha + 1)(\beta + 1)^{\varepsilon} [(\alpha + 1) F/(\beta - \alpha)]^{\frac{\varepsilon\beta-\varepsilon\alpha-\alpha-1}{\beta+1}}$$

The equilibrium number of firms (16) times the level of employment per firm (12) is equal to the total level of employment in the industry:

$$N_M^* L_M^* = (\alpha + 1)(\beta + 1)^{\varepsilon} [(\alpha + 1) F/(\beta - \alpha)]^{\frac{\varepsilon\beta - \varepsilon\alpha - \alpha}{\beta + 1}} \tag{17}$$

4. *Minimum Wage*

Under the same market demand, labor supply, and production conditions, a properly devised minimum wage can increase the level of employment per firm. Enacting a minimum wage will also increase equilibrium average cost and thus price and shift marginal revenue product upward (MRP_M to MRP_C in the figure). A minimum wage that maximizes employment per firm will occur at the point where the new marginal revenue product curve intersects the labor supply (see Figure 3) [7]. Under these conditions the marginal labor cost equals the labor supply price:

$$MLC_C = \frac{dWL}{dL} = W = L^{\beta} \tag{18}$$

The firm's marginal cost [8] is equal to the wage divided by marginal product:

$$MC_C = \frac{MLC}{MP} = \frac{L^{\beta}}{L^{\alpha}} = L^{\beta - \alpha} \tag{19}$$

The firm's average total cost is total cost divided by output:

$$ATC_C = \frac{L^{\beta+1} + F}{\frac{1}{\alpha + 1} L^{\alpha+1}} = (\alpha + 1)(L^{\beta+1} + F) L^{-\alpha-1} \tag{20}$$

[7] An omniscient regulator (or union official) could discern the wage that maximizes employment per firm, otherwise the wage could evolve through trial and error. Also, note that the employment maximizing minimum wage is equal to the wage that would exist if this were a competitive market.

[8] The marginal cost and marginal labor cost curves actually have gaps in them. At the equilibrium levels of output and employment, q_C^* and L_C^* in the figure, either of the two functions for each can be used to determine the desired values. Also, the average total cost curve has a kink in it at q_C^*. For our purposes here, according to Figure 2 and 3, we use W_C for marginal labor cost, MC_C for marginal cost, and ATC_M for average cost.

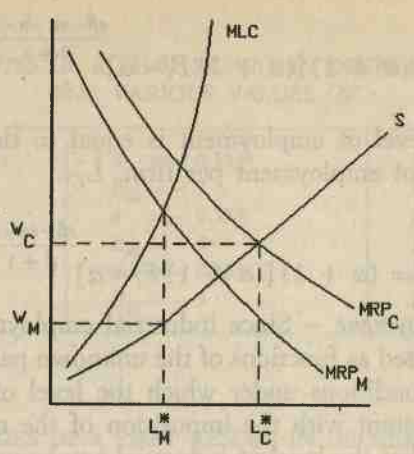

FIGURE 3

At the new equilibrium output MC_C equals ATC_C and thus the equilibrium level of employment with the minimum wage, L_C^*, can be determined by equating (19) and (20):

$$L_C^* = [(\alpha + 1)\, F/-\, \alpha]^{\frac{1}{\beta + 1}} \tag{21}$$

From this equilibrium level of employment, the firm's output, the product price, the industry output, the number of firms, and the industry-wide level of employment can be determined under the minimum wage conditions.

Substituting L_C^* into the production function yields the firm's equilibrium level of output, q_C^*:

$$q_C^* = [1/(\alpha + 1)]\,[\alpha + 1)\, F/-\, \alpha]^{\frac{\alpha + 1}{\beta + 1}} \tag{22}$$

Equilibrium marginal cost and price may be found by substituting L_C^* into equation (19):

$$MC_C^* = [(\alpha + 1)\, F/-\, \alpha]^{\frac{\beta - \alpha}{\beta + 1}} \tag{23}$$

Industry output is found by substituting MC_C^* for price in the industry demand equation:

$$Q_C^* = [(\alpha + 1)\, F/-\, \alpha]^{\frac{\varepsilon\beta - \varepsilon\alpha}{\beta + 1}} \tag{24}$$

The equilibrium number of firms, N_C^*, is equal to Q_C^*/q_C^*:

$$N_C^* = (\alpha + 1)\,[(\alpha + 1)\,F/-\,\alpha]^{\frac{\varepsilon\beta - \varepsilon\alpha - \alpha - 1}{\beta + 1}} \tag{25}$$

The industry-wide level of employment is equal to the number of firms, N_C^*, times the level of employment per firm, L_C^*:

$$N_C^* L_C^* = (\alpha + 1)\,[(\alpha + 1)\,F/-\,\alpha]^{\frac{\varepsilon\beta - \varepsilon\alpha - \alpha}{\beta + 1}} \tag{26}$$

Comparison of Employment. – Since industrial employment under the two conditions are expressed as functions of the unknown parameters, a comparison may yield the conditions under which the level of employment rises, falls, or remains constant with the imposition of the minimum wage. For illustration, assume that the level of industrial employment before the minimum wage, equation (17), is greater than industrial employment after the minimum wage, equation (26):

$$(\alpha + 1)\,(\beta + 1)^{\varepsilon}\,[(\alpha + 1)\,F/(\beta - \alpha)]^{\frac{\varepsilon\beta - \varepsilon\alpha - \alpha}{\beta + 1}} > (\alpha + 1)\,[(\alpha + 1)\,F/-\,\alpha]^{\frac{\varepsilon\beta - \varepsilon\alpha - \alpha}{\beta + 1}} \tag{27}$$

This reduces to

$$\beta + 1 < \left(-\frac{\beta}{\alpha} + 1\right)^{\frac{\varepsilon\beta - \varepsilon\alpha - \alpha}{\varepsilon(\beta + 1)}} \tag{28}$$

Since

$$-\frac{\beta}{\alpha} + 1 > \beta + 1 > 1 \qquad \text{for} \qquad -1 < \alpha < 0,\ \beta > 0 \tag{29}$$

the value of the exponential in (28) is crucial in determining the inequality and thus the impact of the minimum wage on employment. In particular, an exponential value greater than one is a sufficient condition to prove that the inequality holds. On the other hand, a negative exponential would be sufficient to disprove the hypothesis. However, the value of the exponential is strictly less than one, which is not sufficient information to determine the inequality. This of course suggests that the effect of the minimum wage on industry-wide employment cannot be logically determined unless the values

TABLE 1

RESTRICTED VALUES OF β THAT RESULT IN DECREASED EMPLOYMENT FOR VARIOUS VALUES OF ε

$\varepsilon = -2.95$	$\alpha = -0.333$	$\beta > 0.5$
$E_D = -2.95$	$E_M = -3$	$E_L < 2$
$\varepsilon = -1$	$\alpha = -0.333$	$\beta > 1$
$E_D = -1$	$E_M = -3$	$E_L < 1$
$\varepsilon = -0.522$	$\alpha = -0.333$	$\beta > 2$
$E_D = -0.522$	$E_M = -3$	$E_L < 0.5$

TABLE 2

RESTRICTED VALUES OF ε THAT RESULT IN DECREASED EMPLOYMENT FOR VARIOUS VALUES OF α

$\alpha = -0.078$	$\beta = 1$	$\varepsilon < -0.137$
$E_M = -12.82$	$E_L = 1$	$E_D < -0.137$
$\alpha = -0.333$	$\beta = 1$	$\varepsilon < -1$
$E_M = -3$	$E_L = 1$	$E_D < -1$
$\alpha = -0.4766$	$\beta = 1$	$\varepsilon < -1.9$
$E_M = -2.98$	$E_L = 1$	$E_D < -1.9$

TABLE 3

RESTRICTED VALUES OF α THAT DECREASE EMPLOYMENT FOR VARIOUS VALUES OF β

$\beta = 0.5$	$\varepsilon = -1$	$\alpha > -0.0758$
$E_L = 2$	$E_D = -1$	$E_M < -13.186$
$\beta = 1$	$\varepsilon = -1$	$\alpha > -0.333$
$E_L = 1$	$E_D = -1$	$E_M < -3$
$\beta = 2$	$\varepsilon = -1$	$\alpha > -0.4766$
$E_L = 0.5$	$E_D = -1$	$E_M < -2.098$

of α, β, and ε are specified [9]. The tables above illustrate a simulation of possible values of the parameters that lead to a decrease in employment when the minimum wage is imposed.

In Table 1, for example, for given elasticities of marginal product

[9] It is interesting to note that if the minimum wage (which results in optimal labor employment, i.e. $W = MRP$) decreases industry employment, then the monopsony power causes an over-allocation of labor rather than an under-allocation.

($E_M = -3$) and product demand ($E_D = -2.95$) a particular restricted value of labor supply elasticity ($E_L < 2$) exists that results in a fall in employment following the imposition of a minimum wage. Also, from Table 1, as the elasticity of demand for the product falls, the less elastic the supply of labor must be for employment to fall. Conversely, the more elastic the supply of labor, the less inelastic the product demand needs to be in order for the level of employment to fall [10].

In Table 2, for a given elasticity of labor supply, the less elastic the marginal product, the more elastic the product demand needs to be in order for the minimum wage to decrease employment. Conversely, the less elastic the product demand, the more elastic the marginal product needs to be in order for employment to fall. Table 3 shows that the less elastic the supply of labor, the less elastic the marginal product needs to be in order for the minimum wage to decrease employment.

The simulated values illustrate that employment is more likely to fall following the minimum wage if product demand or marginal revenue product are elastic or if labor supply is inelastic. One would suspect that product demand and the firm's marginal revenue product are most elastic in the long run. Thus, the minimum wage would be more detrimental to employment in the long run. On the other hand, it is interesting that the lower the elasticity of labor supply the more likely industry employment will fall when a minimum wage is imposed. If a firm's degree of monopsony power is inversely related to its labor supply elasticity, then the greater the monopsony power in the industry, the more likely a minimum wage will cause employment to fall.

Conclusion

When legislation or a union imposes an industry-wide minimum wage on firms that possess monopsony power in labor markets, but sell their products in a competitive market, the level of employment per firm will rise and the number of firms will decrease. According to the model presented here, the level of employment in the industry will rise or fall depending on the elasticities of marginal product, product demand, and labor supply. In particular, if the marginal product or the product demand are sufficiently

[10] Substituting zero for β in equation (28) making the labor supply infinitely elastic shows that a minimum wage equal to the competitive wage has no effect on employment in the absence of monopsony power.

elastic, or the labor supply is sufficiently inelastic, the total level of employment will fall. The traditional model of monopsony fails to consider the impact of wage policies on the total number of firms in an industry and therefore the level of industrial employment. Before a legislated or union imposed minimum wage can be offered as a boon to labor in monopsony labor markets, the degree of competition in the product market and the parameters determining the relevant elasticities must be assessed.

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MONOPSONIO E SALARIO MINIMO OPPORTUNAMENTE ASSEGNATO: UNA RICONSIDERAZIONE

L'analisi tradizionale del mercato del lavoro monopsonistico suggerisce che un salario minimo opportunamente assegnato aumenta l'occupazione. Questo modo di vedere è corretto quando l'unica impresa gode di una posizione sia di monopsonio sia di monopolio. Tuttavia, se l'impresa è solo una delle tante imprese monopsonistiche che vendono i loro prodotti in un mercato di concorrenza, l'approccio tradizionale non è corretto perché non considera l'influenza del salario minimo sul prezzo del prodotto, sulla produzione e l'occupazione industriale. Il modello teorico qui presentato suggerisce che anche con un salario minimo opportunamente assegnato l'occupazione industriale può diminuire. Le variazioni dell'occupazione dipendono dalle elasticità della domanda del prodotto, del ricavo marginale, e dell'offerta di lavoro.

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PYRAMID DECISION STRUCTURES: FURTHER INSIGHTS

by
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1. *Introduction*

In a previous paper (Catalani and Clerico, 1993) we defined a decision structure, called a pyramid decision structure, with the following characteristics. The structure is composed by a series of levels each of them made out of a number of elements not greater than that of the level immediately below. Now let the decision to be made be of a dichotomous type, for example to accept or to reject a project. Then each level behaves as a polyarchy, that is the level accepts the project if at least one of its members accepts it. Furthermore the levels among them act as a hierarchy, that is the whole structure accepts the project if all the levels accept it. As a matter of convention, let the *bottom level* be that with the greatest number of elements and the *top level* that with the lowest number. Given N, the total number of components of the structure, and k, the number of levels, we have different possible configurations of the pyramid, depending on the distribution of the members across the levels. We introduced a *quasi-lexicographic* ordering of configurations which was identified with a sort of a law of evolution from an originary configuration. The *originary* configuration is characterised by having each level, with the exception of the bottom, containing just one element. Then this law of evolution can be stated in the following way: from each configuration the next one is obtained through a movement of one unity from the bottom level to that immediately above, if it is possible (that is, if the resulting configuration is still a pyramid). If it is not, through a movement of one unity from the second level to the third one, if it is possible... and so on. We start from the originary configuration

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and when we reach a configuration that does not allow further movements we say that we reached the *stable* configuration.

To make things clearer we formalize in this way. A *configuration* of the pyramid, given N and k, to be indicated with $\omega\ (N,\ k)$, is a set of k numbers: $\{n_1,\ n_2,\ ...,\ n_k\}$, such that

$$\sum_{i=1}^{k} n_i = N, \qquad n_1 \geq n_2 \geq ... \geq n_k \tag{1}$$

That is to say: the first number of the set is the number of elements of the bottom level, the last one that of the elements of the top level, and generally the i-th number is the number of elements of the i-th level, $1 \leq i \leq k$. The originary configurations is

$$\omega_o\,(N,\ K) = \{N - k + 1,\ 1,\ ...,\ 1,\ 1\}$$

Even though the present model moves, and borrows terminology, from contributions of Sah and Stiglitz (1985, 1986, 1988, 1991), we have to underline the originality of the developments presented in this paper. This decision structure seems to fit particularly well research institutions, for instance the Italian University as presently organized in three levels. The project that has to be discussed might be envisaged as a research paper: it is then sufficient that one member of a level consider this paper not manifestly bad to pass it to a successive level for further evaluation. But only the approval of all the levels can authorize the publication. In this way it is justified the assumption of a polyarchy within the levels and of a hierarchy between the levels. The aim of this paper is to study in details some characteristics of a decision structure of this kind: mainly how different distributions of the members across the levels affect the quality of the made decision and the time spent to reach the decision.

2. *A New Recursive Formula for the Numbers of Configurations*

In the cited paper (Catalani and Clerico) it was given a formula to calculate, given N and k, the number of resulting configurations. Let us call this number $\nu\ (N,\ k)$. We are going to give here a new formula, in a recursive form, which is more readily understood. Let us say that the numbers N are regular if

$$N \geq \frac{k\,(k+1)}{2} + 1$$

Given a regular N and k, let us define the non-negative integer m in such a way as to satisfy

$$mk + 1 + \frac{k(k+1)}{2} \leq N \leq (m+1)k + \frac{k(k+1)}{2} \qquad m \geq 0$$

Let us define

$$\delta = N - mk - 1 - \frac{k(k+1)}{2}, \qquad \delta = 0, 1, \ldots, k-1$$

Then

$$\nu(N+1, k) = \begin{cases} \nu(N, k) + k - 2 - \delta & \text{if } \delta \leq k-2 \\ \nu(N, k) + k - 1 & \text{if } \delta = k-1 \end{cases}$$

with

$$\nu(N_m, k) = \varphi_k + k - 1$$

where N_m is the minimum value of N, that is

$$N_m = 1 + \frac{k(k+1)}{2}$$

and

$$\varphi_k = 1 + \frac{2k(k-1)(k-2)}{12}$$

3. *A Formula for Determining the Stable Configuration*

Now we are going to establish the formula that allows to write down the stable configuration $\omega_s(N, k)$ when we start with the originary configuration and follow the evolution described above. If

$$N = \frac{k(k+1)}{2}$$

we say that

$$\omega_s(N,\ k) = \{k,\ k-1,\ k-2,\ \ldots,\ 3,\ 2,\ 1\} \qquad (*)$$

The reason for this result is the following. First of all, since this is the stable configuration, each two adjoining levels must differ at most of one element. Secondly, each configuration cannot contain more than one couple of adjoining levels with the same composition (unless the other couple is made out of ones); in the same line each configuration cannot contain a triple of adjoining levels with the same composition, and so on. "Cannot contain" means that such a configuration cannot be found in the dictionary. To show this fact let us assume that indeed there exists such a configuration, for example a configuration with two couples of adjoining levels with the same composition (and none of them made out of ones). Then we should be able moving back in the dictionary to trace back the genetic history of this configuration. What really happens is that we find as an ancestor of this configuration a configuration which is not a pyramid. For example, let this configuration be {5, 5, 4, 3, 2, 2}. Then moving back a step at a time we might have this sequence: {6, 4, 4, 3, 2, 2}, {6, 5, 3, 3, 2, 2}, {7, 4, 3, 3, 2, 2}, {8, 3, 3, 3, 2, 2}, {9, 2, 3, 3, 2, 2}, which is not a pyramid. It follows that necessarily the configuration (*) is the stable configuration.

Now suppose that

$$N = \frac{k(k+1)}{2} + 1$$

Then the same reasoning as before allows us to conclude

$$\omega_s(N,\ k) = \{k,\ k-1,\ k-2,\ \ldots,\ 3,\ 2,\ 2\}$$

Continuing in this way we obtain the general formula: let

$$N - \frac{k(k+1)}{2} = \mu \qquad \mu \geq 0$$

Clearly, μ is an integer. Then we can write

$$\mu = rk + s \qquad s < k \qquad r \geq 0$$

The stable configuration can be written in this way

$$\omega_s(N,\ k) = \{k+r,\ k+r-1,\ k+r-2,\ \ldots,\ r+s+2,\ r+s+1,\ r+s+1,\ r+s,\ \ldots,\ 4+r,\ 3+r,\ 2+r\}$$

where the couple with identical values $r + s + 1$ corresponds to the levels s-th and $(s + 1)$-th descending from the top level, that is going backward from the last element of the previous list. It is just a little bit more complicated to get the formula in the case $\mu < 0$. In this case we can determine i in such a way that

$$ik - \frac{i(i+1)}{2} < \frac{k(k+1)}{2} - N < (i+1)k - \frac{(i+1)(i+2)}{2}$$

where $i = 0, 1, \ldots, k - 2$. Let us call i^* the value of i so determined. Let us put

$$\frac{k(k+1)}{2} - N - i^* k + \frac{i^*(i^*+1)}{2} = t$$

Then we have

$$\omega_s(N, k) = \{k - i^* - 1, k - i^* - 2, k - i^* - 3, \ldots, k - i^* - t, k - i^* - t, k - i^* - t - 1, \ldots, 1, 1\}$$

where the couple having the same value $k - i^* - t$ corresponds to the levels t-th and $(t + 1)$-th ascending from the bottom level, that is moving forward from the first element of the previous list, while the string of ones begins at the $(i^* + 1)$-th level starting from the last element.

4. *The Probability to Accept a Good Project*

We make the following assumptions on the individual behavior. All the members possess the same probability p to make the right decision, and they are independent among them. To simplify matters let us assume that the project under scrutiny is good: then p is the individual probability to accept the project. In the cited paper it was proved that, with $N = 10$ and $k = 3$, the quasi-lexicographic ordering of configurations was consistent with an increasing ordering of the probabilities to accept the project (i.e. to make the right decision), that is, moving ahead in the dictionary of configurations the probability to accept the project increases. Here we are going to generalize this result for arbitrary N and k. The evolution law from the originary configuration, as described, means that we have the sequence

(1) n_1 decreases, n_2 increases, n_3 is constant, ..., n_k is constant,

(2) n_1 is constant, n_2 decreases, n_3 increases, ..., n_k is constant,
(3) n_1 is constant, n_2 is constant, n_3 decreases, ..., n_k is constant,
.....
again (1), (2), (3), ..., until reaching the stable configuration.
Remark. The last configuration of each group is the first of the following group.

Let us consider any two consecutive configurations of the group (1). Let P_{11} and P_{21} be the corresponding probabilities. Then, for some r, and writing $q = 1 - p$

$$P_{11} = (1 - q^{n_1 - r})(1 - q^{n_2 + r})(1 - q^{n_3}) \ldots (1 - q^{n_k})$$

$$P_{21} = (1 - q^{n_1 - r - 1})(1 - q^{n_2 + r + 1})(1 - q^{n_3}) \ldots (1 - q^{n_k})$$

Then, using the result given in the Appendix,

$$(1 - q^{n_1 - r})(1 - q^{n_2 + r}) < (1 - q^{n_1 - r - 1})(1 - q^{n_2 + r + 1})$$

and so

$$P_{11} < P_{21}$$

Now let us consider any two consecutive configurations of the group (2). Let P_{12} and P_{22} be the corresponding probabilities. Then, for some r_1, r_2, r_3

$$P_{12} = (1 - q^{n_1 - r_1})(1 - q^{n_2 + r_2})(1 - q^{n_3 + r_3}) \ldots (1 - q^{n_k})$$

$$P_{22} = (1 - q^{n_1 - r_1})(1 - q^{n_2 + r_2 - 1})(1 - q^{n_3 + r_3 + 1}) \ldots (1 - q^{n_k})$$

Then, using again the result in the Appendix,

$$(1 - q^{n_2 + r_2})(1 - q^{n_3 + r_3}) < (1 - q^{n_2 + r_2 - 1})(1 - q^{n_3 + r_3 + 1})$$

and so

$$P_{12} < P_{22}$$

Repeating the same argument for all the groups and using the *Remark* we can conclude that the probability is strictly increasing moving ahead in the dictionary.

5. *The Expected Number of Evaluations*

Now we want to give a formula to evaluate the expected number of

evaluations in a pyramid with N members and k levels. As usual

$$n_1 \geq n_2 \geq \ldots \geq n_k$$

Let T be the number of evaluations of the structure. Let us denote with τ_i the number of evaluations at level i. Furthermore, let A_i denote the event "the i-th level accepts the project", and A_i^c the event "the i-th level does not accept the project". Then

$$\begin{aligned} E[T] = {} & E[\tau_1|A_1^c]\,\mathbf{Pr}[A_1^c] + [E[\tau_1|A_1] + E[\tau_2|A_2^c]]\,\mathbf{Pr}[A_1, A_1^c] \\ & + [E[\tau_1|A_1] + E[\tau_2|A_2] + E[\tau_3|A_3^c]]\;\mathbf{Pr}[A_1, A_2, A_3^c] \\ & + \ldots \\ & + [E[\tau_1|A_1] + E[\tau_2|A_2] + \ldots + E[\tau_{k-1}|A_{k-1}] + E[\tau_k]] \\ & \cdot \mathbf{Pr}[A_1, A_2, \ldots, A_{k-1}] \end{aligned}$$

Using the independence among levels, rearraging the terms and using properties of the conditional expected value, this expression can be simplified to

$$\begin{aligned} E[T] = {} & E[\tau_1] + E[\tau_2]\,\mathbf{Pr}[A_1] + E[\tau_3]\,\mathbf{Pr}\,[A_1]\,\mathbf{Pr}[A_2] + \ldots \\ & + E[\tau_k]\;\mathbf{Pr}[A_1]\;\mathbf{Pr}[A_2]\cdots\mathbf{Pr}[A_{k-1}] \end{aligned}$$

where

$$E[\tau_i] = \frac{1 - q^{n_i}}{1 - q}, \qquad \mathbf{Pr}[A_i] = 1 - q^{n_i}$$

6. *Superiority of the Extreme Configurations*

We are going to prove that as far as the expected number of evaluations is concerned the first (originary) and the last (stable) configurations are superior, in the sense that there exists a value p^* such that $\forall\, p < p^*$ the stable is the best and $\forall\, p > p^*$ the originary is the best. We speak of superiority since the expected number of evaluations can be considered as a measure of the time spent in reaching the decision and we would like to minimize this time. We are going to prove this for $k = 2$ and for N even, but numerical analysis shows that the same result holds for $k > 2$ and any N. In the analysed case it is easy to see that the number of configurations is $\nu = \frac{N}{2}$. Let us denote with ω_1 the originary configuration, with

ω_v the stable configuration and with ω_b the b-th configuration, $b = 2, 3, \ldots, \frac{N}{2} - 1$. Then

$$\omega_1 = \{N - 1, 1\}$$

$$\omega_v = \left\{\frac{N}{2}, \frac{N}{2}\right\}$$

$$\omega_b = \left\{\frac{N}{2} + s, \frac{N}{2} - s\right\} \qquad s = \frac{N - 2b}{2}$$

In this way

$$1 \leq s \leq \frac{N - 4}{2}$$

Now using the formula to calculate the expected number of evaluations and denoting with n_{1i} the number of elements of the bottom (first) level of the i-th configuration, $i = 1, 2, \ldots, \frac{N}{2}$ and denoting with T_i the total number of evaluations of the i-th configuration we have

$$\lim_{p \to 0} E[T_i] = n_{1i}$$

$$\lim_{p \to 1} E[T_i] = 2$$

and the functions are continuous.

So we are interested in the behavior of the functions for p belonging to the open interval (0, 1). First of all we are going to prove that the equation in p: $E[T_1] = E[T_{N/2}]$ has a unique solution in the relevant interval, showing that the last configuration is better for values of p inferior to this solution and it is worse for values superior to this solution, which will be denoted with p^*. We have

$$E[T_1] = \frac{1 - q^{N-1}}{1 - q} \quad +\tilde{}\, 1 - q^{N-1}$$

$$E\left[T_{N/2}\right] = \frac{1 - q^{N/2}}{1 - q} + \frac{1 - q^{N/2}}{1 - q}\left(1 - q^{N/2}\right)$$

Equating these two expressions and simplifying we get

$$2q^{N-2} - 3q^{(N-2)/2} + 1 = 0$$

Setting $q^{(N-2)/2} = \nu$ we reduce to

$$2\nu^2 - 3\nu + 1 = 0$$

which has a unique solution in the interval (0, 1), that is

$$\nu = \frac{1}{2}$$

and so

$$q^* = \left(\frac{1}{2}\right)^{\frac{2}{N-2}} \quad \text{and} \quad p^* = 1 - q^*$$

We can see that p^* decreases steadily as N increases, and

$\lim_{N \to \infty} p^* = 0$.

Now we are going to show that $\forall\, p < p^*$ the last configuration is superior to the h-th configuration, $h = 2, 3, \ldots, \frac{N}{2} - 1$. We have

$$E[T_h] = \frac{1 - q^{\frac{N}{2}+s}}{1-q} + \frac{1 - q^{\frac{N}{2}-s}}{1-q}\left(1 - q^{\frac{N}{2}+s}\right)$$

Equating this expression to $E\left[T_{N/2}\right]$ and simplifying we get

$$2q^{\frac{N}{2}+s} - 3q^{N/2} + q^{\frac{N}{2}-s} = 0$$

The unique solution to this equation in the interval (0, 1) is given by

$$\bar{q} = \left(\frac{1}{2}\right)^{\frac{1}{s}}$$

Given the range of values of s it follows that

$$\frac{1}{s} > \frac{2}{N-2}$$

which implies

$$q^* > \bar{q}, \qquad \text{and so} \qquad p^* < \bar{p}$$

This fact coupled with the behavior in the neighbouring of $p = 0$ allows us to conclude that $\forall\ p < p^*$

$$E[T_b] > E\left[T_{N/2}\right]$$

Now we are going to show that $\forall\ p > p^*$ the first configuration is superior to the b-th configuration, $b = 2, 3, \ldots, \frac{N}{2} - 1$. Let us define

$$\Delta = E[T_b] - E[T_1]$$

Then with a little algebra we get

$$\Delta = q\left(1 - q^{\frac{N}{2}-s-1}\right)\left(1 - 2q^{\frac{N}{2}+s-1}\right)$$

so that the sign of Δ depends on the sign of the last factor. Since

$$\frac{2}{N-2} > \frac{1}{\frac{N}{2}+s-1}$$

it follows

$$\frac{1}{2}^{1/(N/2+s-1)} > \frac{1}{2}^{2/(N-2)}$$

Then

$$p > p^* \Rightarrow q < q^* \Rightarrow q < \frac{1}{2}^{2/(N-2)} \Rightarrow q < \frac{1}{2}^{1/(N/2+s-1)}$$

Consequently, $\forall\ p > p^*$,

$$\Delta > 0$$

which proves our assertion.

7. *Concluding Remarks*

Two features characterize the model of decision structure proposed in this paper: first of all, the quasi-lexicographic ordering of the configurations resulting from given N (total number of members) and k (number of levels); secondly, the particular decision rules that govern the decision process, that is polyarchy within the levels, and hierarchy between the levels. Two main results are obtained. The first one is that the introduced ordering is consistent with the ordering of the probabilities to make the right decision, whatever be p, the individual skills; the second one is related to the expected total time necessary to reach the decision, measured by the expected total number of evaluations: here for low values of p the last (stable) configuration is superior, while for medium and high values of p the first (originary) configuration is superior. The other configurations are never superior. To put it bluntly, looking at the appearance of the first and of the last configuration, this second result means that if the members of the organization are not brilliant then it is better to resort to a "democratic" structure, while if they are brilliant the optimal solution is an "oligarchic" structure.

APPENDIX

To prove, if $n_1 > n_2 + 1$,

$$\frac{1 - q^{n_1 - 1}}{1 - q^{n_2}} > \frac{1 - q^{n_1}}{1 - q^{n_2 + 1}}$$

Proof
Let us consider the function

$$f(k) = \frac{1 - q^{x+k}}{1 - q^{y+k}} \qquad x > y, \qquad 0 < q < 1$$

The numerator of the derivative with respect to k, after dividing for q^k is equal to

$$\log q[(1 - q^{x+k})\, q^y - (1 - q^{y+k})\, q^x]$$

It follows that

$$\frac{\partial f(k)}{\partial k} < 0$$

and this proves our assertion.

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STRUTTURE DECISIONALI DI TIPO PIRAMIDALE: PROPRIETÀ ULTERIORI

In questo lavoro vengono analizzate ulteriori proprietà di un modello, strutture decisionali a piramide, presentato in un precedente saggio. Questo modello si presenta come un mix di poliarchia e gerarchia. Viene provato che un ordinamento delle configurazioni che risultano dalle differenti disposizioni dei membri tra i livelli secondo una legge di evoluzione enunciata è consistente con quello delle probabilità di prendere la decisione corretta. Inoltre viene mostrato che in termini di tempo necessario per prendere una decisione la prima e l'ultima configurazione del precedente ordinamento sono sempre superiori. Vengono inoltre presentati alcuni risultati minori in analisi combinatoriale.

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A NOTE ON EMPLOYMENT UNDER WAGE DISCRIMINATION

by
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1. *Introduction*

In her famous book, *The Economics of Imperfect Competition* (1933), J. Robinson examined the impact of price discrimination on total output and observed the following important propositions.

R.1. The slope of the marginal cost enters into the determination of the size of the output change but not the direction of that change by discrimination.
R.2. A necessary condition for lower prices in two separate markets is a decreasing marginal cost function [1].

Later, E. Silberberg (1970), K.G. Lofgren (1977) confirmed Robinson's R.1. mathematically, and W.J. Smith and J.P. Formby (1981) demonstrated R.1. graphically. K.G. Lofgren (1977) also obtained R.2. mathematically.

Recently, M. Bronfenbrenner (1971), R.B. Ekelund, R.S. Higgins and

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[1] Robinson states that "When the output is altered by the introduction of price discrimination the marginal cost may be altered. It is true that when output would be increased by discrimination the increase will be carried less far if marginal costs are rising; and if output would be reduced by discrimination it will be reduced by less if marginal costs are falling (so that the cost of a smaller output is greater than of a larger output). But the alteration in marginal cost cannot be sufficient to prevent the change in output, for if it were so the alteration in marginal cost would not occur. Moreover, if marginal cost is falling, an increase in output due to discrimination will be enhanced; and if marginal costs are rising, a decrease in output will be enhanced. If the increase in output due to price discrimination is sufficiently great and if marginal cost is falling sufficiently rapidly, the effect of discrimination may be to lower the price in both markets". (1933, pp. 194-195).

C.W. Smithson (1981), C.C. Mai and J.J. Shih (1982), and J.P. Formby, S. Layson and W.J. Smith (1982) extended Robinson's neoclassical theory of price discrimination to the hiring of labor. M. Bronfenbrenner (1971) showed graphically that total employment is unchanged by wage discrimination if two supply curves in two separate markets are linear. R.B. Ekelund, R.S. Higgins and C.W. Smithson (1981) examined the non-linear case and showed that the wage discrimination will increase total employment if two supply curves are both concave (convex) and the relatively elastic supply curve has a lower adjusted concavity. C.C. Mai and J.J. Shih (1982) exploited a Lagrangian technique suggested by W. Leontief (1940) to show that R.B. Ekelund, R.S. Higgins and C.W. Smithson's results are valid only when the point of maximum non-discriminatory profits and maximum discriminatory profits are very close together. J.P. Formby, S. Layson and W.J. Smith (1982) used a counter-example to show the fallibility of the "adjusted concavity" criterion in predicting the sign of change in total employment by wage discrimination and offered an alternative criterion which they called the *SMC-DMC* (simple monopsonist's factor cost curve-discriminatory monopsonist's factor cost curve) criterion [2]. However, these writers did not examine the role of marginal revenue product in wage discrimination and the necessary condition for higher wages in both markets explicitly.

The purpose of this paper is to fill this gap. Following K.G. Lofgren's approach, we show mathematically that the slope of the marginal revenue product curve enters into the determination of the size of the employment change but not the sign of that change by wage discrimination. We also show that a necessary condition for higher wages in both labor markets by wage discrimination is an increasing marginal revenue product curve. This indicates that the gist of R.1. and R.2. does carry over to the employment effect of wage discrimination.

2. *The Model*

Suppose that a monopsonist uses a single input, labor, to produce a product which was sold in a monopolistic market. Assume also that workers

[2] In a passing note, FORMBY, LAYSON and SMITH (1982) mentioned that the sign of change in employment is independent of the slope of *MRP* (marginal revenue product) curve. But they did not show it.

are segregated into two markets and the monopsonist hires workers from both markets. The cost functions are

$$C_i(L_i) = W_i L_i = f_i(L_i) L_i \tag{1}$$

where W_i is the wage rate and L_i is employment in market i. $W_i = f_i(L_i)$ is the supply curve, $dW_i/dL_i = f_i' > 0$ and $i = 1, 2$. The production function can be specified as:

$$q = G(L) = G(L_1 + L_2),\ G_L = dq/dL > 0,\ G_{LL} = d^2q/dL^2 < 0 \tag{2}$$

where $L = L_1 + L_2$ is total employment. The revenue function is

$$R = p(q)\, q = p[G(L)]\, G(L), \qquad p_q = dp/dq < 0 \tag{3}$$

where $p(q)$ is the demand function in the output market.

To investigate the effect of wage discrimination on total employment of a monopsony, we follow K.G. Lofgren (1977), C.C. Mai and J.J. Shih (1982), and E. Silberberg (1970), and specify the objective function of a monopsony as:

$$\text{Max } \pi = p(q)\, q - C_1 - C_2, \text{ st. } W_1 - W_2 = k \tag{4}$$

where k is a parameter. In the simple monopsony case, $W_1 = W_2$ and $k = 0$. In the discriminating monopsony case, $W_1 - W_2 = k > 0$. Via the standard comparative statics, we can examine how total employment changes when k moves from zero to equilibrium value, $k^* = W_1^* - W_2^*$, under the maximum discriminatory profits, π_d^*, or from k^* towards zero under the maximum non-discriminatory profits π_s^*.

The Lagrangian function of this constrained profit maximization problem is:

$$V = p[G(L_1 + L_2)]\, G(L_1 + L_2) - W_1(L_1) L_1 - W_2(L_2) L_2 + \lambda(k - W_1 + W_2) \tag{5}$$

where λ is the Lagrange multiplier, and L_1, L_2 and λ are choice variables.

The first-order conditions are obtained by setting the first partial derivative of V with respect to L_1, L_2 and λ equal to zero:

$$V_{L1} = MRP - MFC_1 - \lambda f_1' = 0 \tag{6}$$

$$V_{L2} = MRP - MFC_2 + \lambda f_2' = 0 \tag{7}$$

$$V_\lambda = k - W_1 + W_2 = 0 \tag{8}$$

where $MRP = (p + p_q q)\, G_L = (MR)\, G_L$ is the marginal revenue product, $MFC_i = W_i + L_i f_i'$ is the marginal factor cost. From (6) and (7), we obtain

$$(MRP - MFC_1)/(MRP - MFC_2) = -(f_1'/f_2') \tag{9}$$

In other words, the ratio of the difference between MRP and MFC in each market equals the negative ratio of the slopes of labor supply curves. Equations (6) and (7) can also be written as

$$\lambda = (MFC_2 - MFC_1)/(f_1' + f_2') \tag{10}$$

where $\lambda = d\pi/dk$ is the rate of change of profits when the constraint is relaxed or tighten, L_1 and L_2 adjusting to the new equilibria.

The second-order sufficient condition requires that the following bordered Hessian determinant be positive:

$$D = \begin{vmatrix} MRP' - MFC_1' - \lambda f_1'' & MRP' & -f_1' \\ MRP' & MRP' - MFC_2' + \lambda f_2'' & f_2' \\ -f_1' & f_2' & 0 \end{vmatrix}$$

$$= -MRP'(f_1' + f_2')^2 + (f_1')^2 MFC_2' + (f_2')^2 MFC_1' + \lambda [f_1''(f_2')^2 - f_2''(f_1')^2] > 0 \tag{11}$$

where $MRP' = (2p_q + p_{qq}q)\, G_L^2 + (MR)\, G_{LL}$, $MFC_i' = 2f_i' + L_i f_i''$. If the second-order condition is satisfied, we can solve (6)-(8) for the optimal values of L_1, L_2 and λ.

$$L_1 = L_1(k), \qquad L_2 = L_2(k), \qquad \lambda = \lambda(k) \tag{12}$$

It should be noted that at maximum discriminatory profits, $MFC_1 = MFC_2 = MRP$ and the optimal value of $\lambda = d\pi/dk = 0$. To ease our analysis, we assume that the local maximum solution in (12) is also a global maximum solution. This completes the model that constitutes our basic analytical framework.

3. *Effects of Wage Discrimination*

We are now in a position to examine the effects of wage discrimination on total employment and wage rates. Totally differentiating (6)-(8), and using Cramer's rule, we obtain

$$dL_1/dk = (-1/D)\,[(MRP' - MFC_2')\, f_1' + MRP' f_2' + \lambda f_2'' f_1'] \tag{13}$$

$$dL_2/dk = (1/D)\,[(MRP' - MFC_1')\,f_2' + MRP'f_1' - \lambda f_1''f_2'] \tag{14}$$

$$\begin{aligned} dL/dk &= dL_1/dk + dL_2/dk \\ &= (1/D)\,[MFC_2'f_1' - MFC_1'f_2' - \lambda\,(f_1''f_2' + f_2''f_1')] \end{aligned} \tag{15}$$

where $D > 0$. Clearly, the sign of dL/dk is ambiguous. However, from (15), it is easy to see that the slope of MRP does not appear in the numerator of dL/dk. From (15) and (11), it is also easy to see that MRP' and D move in the opposite direction, dL/dk is larger the larger MRP'. Thus, we can conclude that

P.1. The sign of the change in total employment by wage discrimination is independent of the slope of the marginal revenue product, but the size of the change in total employment is not independent of the slope of the marginal revenue product.

It is clear that P.1. is quite similar to R.1.

Next, we examine the employment effect of wage discrimination at the maximum discriminatory profits, i.e., $\lambda = 0$. Substituting $\lambda = 0$ into (13) - (15), we obtain

$$dL_1/dk = (-\,1/D)\,[MRP' - MFC_2')\,f_1' + MRP'f_2'] \tag{16}$$

$$dL_2/dk = (1/D)\,[MRP' - MFC_1')\,f_2' + MRP'f_1'] \tag{17}$$

$$\begin{aligned} dL/dk &= dL_1/dk = dL_2/dk \\ &= (1/D)\,(MFC_2'f_1' - MFC_1'f_2') \\ &= (1/D)\,f_1'f_2'\,(A_2 - A_1) \end{aligned} \tag{18}$$

$$D = -\,MRP'\,(f_1' + f_2')^2 + (f_1')^2\,MFC_2' + (f_2')^2\,MFC_1' \tag{19}$$

where $A_i = L_if_i''/f_i'$ is the adjusted concavity of labor supply curve in market i. $D > 0$ if the second-order condition is met.

Since $f_i' > 0$, $k = W_1 - W_2 > 0$, and $D > 0$, from (18), we can see that

$$dL/dk > 0 \text{ if } A_2 > A_1 \tag{20}$$

Thus, we have

P.2. If the relatively more elastic supply curve has a lower adjusted concavity, wage discrimination will increase total employment.

This result is identical to Ekelund, Higgins and Smithson's (1981), Mai and Shih's (1982). It is of interest to note that if both supply curves are linear, $f_i'' = 0$ and $A_i = 0$. Substituting these conditions into (18), we obtain the following well-known result:

$$dL/dk = 0 \tag{21}$$

Thus, we have

P.3. If both supply curves are linear, total employment is unchanged by wage discrimination.

This result is consistent with the geometrical result obtained by M. Bronfenbrenner (1971), R.B. Ekelund, R.S. Higgins and C.W. Smithson (1981), and J.P. Formby, S. Layson and W.J. Smith (1982), and the mathematical result obtained by C.C. Mai and J.J. Shih (1982).

Finally, we examine the effect of wage discrimination on wage rates. At maximum discriminatory profits, the second-order conditions require that

$$MRP' - MFC_1' < 0 \text{ and } MRP' - MFC_2' < 0 \tag{22}$$

Substituting (22) into (16) and (17), we can show that a necessary condition for $dL_1/dk > 0$ and $dL_2/dk > 0$ is an increasing slope of MRP [3], i.e.,

$$MRP' > 0 \tag{23}$$

Substituting $dL_1/dk > 0$ and $dL_2/dk > 0$ into the supply curves, we obtain

$$dW_1/dk = f_1'(dL_1/dk) > 0,\ dW_2/dk = f_2'(dL_2/dk) > 0 \tag{24}$$

Thus, we can conclude that

P.4. A necessary condition for higher wages in both markets under discrimination is an increasing marginal revenue product curve.

Clearly, this result is quite similar to R.2.

4. *Conclusions*

J. Robinson in her 1933 book briefly considered the effects of wage

[3] If $MRP' < 0$, from (16) and (17), we get $dL_1/dk > 0$ but $dL_2/dk < 0$.

discrimination, and noted that "The analysis is in everyway symmetrical with the analysis of discrimination under monopoly" (p. 225). Recent writers only examined the employment effect of wage discrimination and ignored the impact of marginal revenue product function on total employment. In this note, we have shown explicitly that the slope of the marginal revenue product curve enters into the determination of the size of the employment change but not the sign of that change by wage discrimination. We have also shown that a necessary condition for higher wages in both labor markets by wage discrimination is that the slope of marginal revenue product be positive. Our results demonstrate that the gist of R.1. and R.2. in the output market carries over to the input market, and the symmetry of input and output markets holds.

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NOTA SULL'OCCUPAZIONE CON DISCRIMINAZIONE SALARIALE

Questo articolo esamina il ruolo del ricavo marginale sugli effetti della discriminazione salariale. Si mostra che la curva del ricavo marginale influisce sull'ammontare della variazione dell'occupazione ma non sul segno della variazione dovuta alla discriminazione salariale. Mostra anche che una condizione necessaria per avere salari più elevati in entrambi i mercati del lavoro con discriminazione salariale è una curva crescente del ricavo marginale. Questo indica che alcune importanti affermazioni circa l'effetto sulla produzione della discriminazione del prezzo valgono anche per l'effetto sull'occupazione della discriminazione salariale.

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INVESTMENTS IN TOURISM DEVELOPMENT AND THE DEMAND FOR TRAVEL

by
NECLA V. GEYIKDAGI *

1. *Introduction*

Tourism can make significant economic and social contributions to most countries in the world. However, it is of even greater importance for developing countries since, being a labour intensive sector, it can alleviate unemployment while bringing in foreign currency which is much needed in development efforts. It would thus be essential to know the factors influencing the demand for travel to a certain country.

Using the case of Turkey, a rapidly developing travel market, this paper attempts to build an econometric tourism demand model by adding a new factor, the improvement of the tourism product, to previously used determinants such as the income of tourists, transportation costs, exchange rates, the own price of the product and the price of its substitutes. One can surmise that for a developing country with an initially insufficient tourism product, it is critically important to improve it in order to attract more foreign tourists. In other words, better and more hotels, restaurants, airports, roads, means of transportation etc., which make up the tourism product, could play a major role in increasing the number of travellers coming to the country.

2. *The Turkish Tourist Market*

The 1980s witnessed a remarkable development in demand for Tur-

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kish tourism. With the exception of two years of decline, 1982 and 1986, the number of foreign travellers steadily increased from 1.3 million in 1980 to 5.4 in 1990 (Turkish Ministry of Tourism 1991, p. 81). The first decline coincided with the economic recession of the early 1980s. The second one occurred when a series of international terrorist acts resulting in the bombing of Libya by the Americans and the Chernobil nuclear accident precipitated a brief reduction in international travel to several countries of Europe.

The growth of tourism receipts were even more remarkable. Earnings from tourism increased from $327 million in 1980 to $3,308 million in 1990 (ibid). However, a change in the data collection methods at the end of 1983 is believed to be responsible for at least a part of this increase (Tüsiad, 1988, p. 16).

The Turkish public sector played a leading role in investing in the tourism sector. The Turizm Bankasi (Tourism Bank) was established by the government in 1955 with the aim of undertaking all kinds of tourism investments as well as offering credits to the private investors. Two other banks [1] as well as the State Pension Fund were urged to invest in the accommodation sector (Sahin, 1990). Until the mid-1980s, the public sector invested more than the private sector in tourism providing both infrastructure and superstructure (Geyikdagi, 1992). When the major infrastructure projects were completed and the international tourism demand gained momentum, private investors (both domestic and foreign) have shown a greater interest in tourism investments, especially after 1984. Then, the principal public investor, the Tourism Bank, was advised to leave the field of direct investments, and focus on providing credits to the private sector (State Planning Organization, 1985, p. 134). In fact, its properties have been put on the market for sale as a part of the privatisation programme in 1988. While the total fixed investments in Turkey increased slightly more than 4 times, fixed investments in tourism rose by 30 times in real terms between 1965 and 1989 (Tobb, 1990, p. 23).

3. *Demand Analysis*

Specification of the Model. – Previous studies have established that disposable income, cost of tourism in the destination, cost of substitutes, exchange rates and transportation costs were factors affecting tourism demand. The econometric model in this study employs per capita tourist arrivals in

[1] Iller Bankasi and Türkiye Emlak Kredi Bankasi.

Turkey as the dependent variable. Since the demand for foreign tourism from a given country is expected to depend on the population of that country, *ceteris paribus*, population is sometimes included as an explanatory variable. However, this study adopts the practice of modifying the dependent variable, like some other authors (Bechdolt, 1973 and Witt, 1980) did before, by dividing the number of arrivals from the origin into its population.

Explanatory variables are the real disposable per capita income in the origin country, the price of tourism in Turkey (the cost of living for tourists in Turkey and the cost of travel to Turkey), a substitute price (as a weighted composite of the cost of living in two substitute destinations, Italy and Greece, and the transport costs to them as well as the origin country cost of living for tourists) and the exchange rate of the Turkish Lira against the origin country currencies. In addition to these usual variables, a two-year lagged real gross fixed investment in the Turkish tourism sector was included as a proxy to the progress and the improvement of the tourist product. The duration of the lag was based on the consideration that tourism projects took an average of two years for completion. Two dummy variables were also incorporated into the model to take into account the effects of the political turmoil of 1980 in Turkey and the bombing of Libya in 1986 by the Americans. In order to see changing tastes for Turkish tourism, a trend term was also included in the model.

While the inclusion of promotional expenditures was considered, it was not possible to construct an appropriate form of variable. First, the marketing activities, which were supported by the Turkish Ministry of Tourism, constitute only a part of the overall promotional efforts. When the support of the foreign tourist operators was combined with the well organised travel trade in Turkey, the tourism marketing done by the private sector proved to be quite successful. However, it was not possible to provide data on the promotional expenditures of the private sector. Secondly, the Turkish government recognised that demand was generally running ahead of supply, especially in the mid-1980s, and the Ministry of Tourism maintained a low profile in marketing (Turkish Ministry of Tourism, 1990). Despite significant decreases in the promotional expenditures, the volume of tourism to Turkey continued to grow steadily.

The relationship among the relevant variables are expressed in the double logarithmic form. The double logarithmic demand functions have been the most frequently employed econometric form in such analyses for two main reasons. First, it is practical to employ logarithmic transformations to fit nonlinear functions into linear ones so that the ordinary least square

(OLS) method can still be used. Secondly, the parameters of the double logarithmic equation are the elasticities of the respective variables and the equation corresponds to a preference ordering of behavioural demand functions.

The specification of the model is

$$\ln \frac{A_{jt}}{P_{jt}} = \alpha_{1j} + \alpha_{2j} \ln \frac{Y_{jt}}{P_{jt}} + \alpha_{3j}\ln C_{jt} + \alpha_{4j}\ln L_{jt} + \alpha_{5j}\ln E_{jt} + \alpha_{6j}\ln S_{t-2} + \alpha_{7j} DV1_t + \alpha_{8j} DV2_t + \alpha_9 T + u_{jt}$$

$j = 1, \ldots 12$ (origin countries)
$t = 1, \ldots 14$ ($1 = 1976, \ldots 14 = 1989$)

where,

A_{jt} is the number of tourist arrivals in Turkey from country j in year t

P_{jt} is country j's population in year t

Y_{jt} is the real national disposable income (in 1975 prices) of country j in year t

C_{jt} is the total of a ten-day period cost of living for tourists in Turkey and the cost of travel from origin j in year t (in 1975 prices)

L_{jt} is a weighted average of the cost of tourism in substitute destinations for residents of origin j in year t including the travel costs from origin j to substitute destinations (in 1975 prices)

E_{jt} is the value of country j's currency in terms of Turkish Lira in year t

S_{t-2} is the gross fixed investment (in 1975 prices) in the Turkish tourism sector lagged two years

$DV1_t$ is a dummy variable to measure the impact of the political turmoil in 1980 and 1981 ($DV1_t = 1$ if $t = 5$ and $t = 6$, 0 otherwise)

$DV2_t$ is a dummy variable to capture the effects of the 1986 bombing of Libya ($DV2_t = 1$ if $t = 11$)

T is the trend term

u_{jt} is a random disturbance term

$\alpha_{1j}, \ldots \alpha_{9j}$ are parameters to be estimated.

Data and Estimation Procedure. – The dependent variable, the quantity of tourism or the number of arrivals at the frontiers, were extracted from OECD's *Tourism Policy and International Tourism in OECD Member Coun-*

tries. The population figures are from the various issues of Euromonitor's *European Marketing Data and Statistics.*

Since the disposable income takes into account the transfers from abroad, it was preferred to national income. J.R. Artus (1972) and S.Y. Kwack (1972) also used disposable income in their analyses. OECD's *National Accounts* (1989 and 1990) were the data sources for the income variable.

As the tourism product is made up from various commodities, and each tourist has a different spending pattern, there is no single tourism price. In this analysis, daily tourist prices, consisting of the cost of lodging, two meals and a breakfast were calculated for each country. *Fodor's Europe 1990* gives average tourist costs in 1990. These prices were deflated by the hotel and restaurant price indices based on the average changes extracted from OECD's *Tourism Policy and International Tourism in OECD Member Countries* to provide series covering the whole 1976 to 1989 period. Since about 80 per cent of the tourists from Western Europe to Turkey travel by air, air fares are assumed to represent travel costs. However, the model of Greece does not include air fares as the majority of Greek tourists travel to Turkey by land and sea. Air fares were extracted from the *ABC World Airways Guide* (Reed Travel Group) and exchange rates were taken from the International Monetary Fund's *International Financial Statistics Yearbook* (1990). The tourists' cost of living for ten days in Turkey and the cost of travel from origin to Turkey were combined to reach a single own price for each country.

Another price variable used by researchers is the tourist prices in competing destinations including the own country of the tourists themselves. While some authors (Jud and Joseph, 1974; Uysal and Crompton, 1985) included only tourists' cost of living in substitute destinations, others (Witt and Witt, 1990) employed both tourists' cost of living and travel costs to the alternative destinations as separate variables. This study, however, like the work of Little (1980), employs a weighted average cost of substitute destinations, combining both tourists' living costs and transport expenses in a single variable. The weights which were based on the relative market shares of the competing destinations were used by some researchers (Jud and Joseph, 1974 and Little, 1980).

Two Mediterranean destinations, Greece and Italy, were selected in addition to each origin country, as possible substitute destinations. Like Greece and Italy, Turkey is endowed with a comparable historical heritage as well as a mild Mediterranean climate. Hence, the substitute price, faced by the tourists of each origin country, was calculated as the composite of the

tourist prices in the three countries. Since air travel is not the most popular form of transport from Greece to Italy and Turkey, air transport costs were not included in the model of Greece. Obviously, the tourists from Italy and Greece would have two substitute destinations, not three as in other origin countries. The composite substitute prices were calculated for each origin country by applying weights based on their market shares of Italy and Greece and an arbitrary weight of 0.5 for the own country of tourists. The origin country has been given this constant weight of 0.5, assuming that domestic tourism was the major competitor for any foreign holiday (Loeb, 1982; Uysal and Crompton, 1985; Witt and Witt, 1990). However, the weights for the two substitute Mediterranean destinations change over time as a moving average of the previous three years' demand for these destinations.

The supply (product improvement) variable is the real fixed capital investment (in 1975 prices) in the tourism sector of Turkey realised two years earlier. The data have been obtained from *OECD Economic Surveys: Turkey* for various years.

A separate demand equation for each origin country, Austria, Belgium, Finland, France, Greece, Germany, Italy, the Netherlands, Sweden, Switzerland, the United Kingdom and the Unites States, was estimated by using the OLS procedure. The Durbin-Watson (D-W) statistic was calculated to check the presence of autocorrelation. Whenever autocorrelation appeared, the equation was reestimated by using the Cochrane-Orcutt (CO) procedure.

Results. – Each model has been estimated for all possible subsets of explanatory variables. The most satisfactory models have been chosen and presented in Table 1. The criteria for the satisfactoriness are (i) an F statistic indicating that the equation is significantly different from zero at the 5 per cent level, (ii) "correct" signs for the coefficients, and (iii) a D-W statistic lying between 1.6 and 2.4.

A positive sign for the income, exchange rate, substitute prices and supply coefficients and a negative sign for the coefficients of own price and the dummy variables are theoretically expected. Whenever its coefficient had a wrong sign, that variable was deleted from the equation or tried in another set of variables. Since there are no clear cut rules for choosing the best estimated models, the process contains a certain extent of subjectivity. The most satisfactory results were selected by comparing R^2 (or corrected R^2, $\bar{R}^2$) values and t statistics. Where the coefficients are not statistically significant but have correct signs, weak support is exhibited for their inclu-

TABLE 1

TOURISM DEMAND REGRESSION RESULTS

Origin Country	Constant	Income	Own Price	Substitute Price	Exchange	Supply	Dummy1	Dummy2	Trend	$\bar{R}^2$	R^2	F	D-W	Method
AUSTRIA	-24.065 * (-3.627)	--	--	3.048 * (4.113)	--	0.256 * (2.331)	-0.200 (-1.166)	--	--	0.85	0.92	18.850	2.104	OL
BELGIUM	-14.214 (-0.280)	1.070 (0.255)	--	0.294 (0.530)	--	0.456 * (2.680)	-0.335 (-1.430)	--	--	0.79	0.88	8.207	1.796	OL
FINLAND	4.922 (0.506)	--	-0.374 (-0.348)	--	--	0.256 (1.047)	-0.064 (-0.158)	--	0.191 * (5.728)	0.93	0.97	30.473	2.242	OL
FRANCE	2.431 * (5.050)	--	--	--	--	0.429 * (6.550)	-0.276 * (-2.266)	-0.026 (-0.164)	--	0.85	0.92	18.841	1.660	OL
GERMANY	-5.197 (-1.437)	--	-0.622 (-1.302)	1.549 * (3.017)	--	0.562 * (5.164)	-0.495 * (-2.895)	--	--	0.96	0.98	47.368	1.679	OL
GREECE	11.536 * (3.459)	--	-0.676 (-1.693)	--	0.780 * (7.050)	--	-1.017 * (-3.095)	--	--	0.93	0.96	40.263	2.266	CO
HOLLAND	-77.291 (-2.136)	6.358 (1.914)	--	2.309 (2.178)	--	0.522 * (4.341)	-0.456 (-1.972)	-0.003 (-0.011)	--	0.89	0.95	13.547	2.131	OL
ITALY	-4.659 (-0.465)	--	-0.283 (-0.699)	1.027 (0.745)	--	0.296 * (2.654)	-0.281 (-2.281)	--	--	0.86	0.92	11.939	2.331	CO
SWEDEN	-9.864 (-0.321)	0.713 (0.193)	--	0.256 (0.257)	--	0.760 * (3.216)	-0.122 (-0.523)	--	--	0.88	0.94	16.073	2.142	OL
SWITZERLAND	0.389 (0.043)	--	-0.323 (-0.394)	0.738 (0.624)	--	0.374 (1.567)	-0.612 (-1.854)	--	--	0.70	0.84	5.201	2.213	OL
U.K.	-13.366 (-3.023)	--	--	2.522 * (2.949)	--	0.642 * (6.940)	-0.159 (-1.144)	--	--	0.95	0.97	60.972	2.027	OL
U.S.A.	3.968 * (5.041)	--	--	--	0.016 (0.310)	0.024 (0.186)	-0.330 (-1.848)	-0.755 * (-3.054)	--	0.58	0.76	3.151	1.648	OL

NOTES: t values in parentheses. * Significant at 5% level.

sion in the model. In this study, variables with coefficients which were not significant but had the correct sign were therefore still retained.

Contrary to all expectations, the income coefficients had either wrong signs or were statistically insignificant even when one-year lagged variables were used. The income variable appeared in three of the models, having coefficients which range from 0.713 for Sweden to 6.358 for Holland. Thus, a real disposable income rise of 1 per cent in the Netherlands is estimated to result in a 6.358 per cent increase in tourist arrivals to Turkey from this country, *ceteris paribus.*

The own price variable appeared in five of the twelve models although the coefficient was not significant in any case. The model of Greece had the highest coefficient for the own price, followed by Germany. For example, a 1 per cent decrease in the own price of Turkish tourism (the composite of the real cost of living and the transport cost to Turkey) would result in a 0.622 per cent increase in tourist arrivals from Germany to Turkey, other things remaining constant.

In Table 1, eight models contained substitute price variables with coefficients ranging from 0.256 for Sweden to 3.048 for Austria. However, the interpretation of the substitute variable is not so simple since it is a composite of different costs the effects of which cannot be separated easily. When explaining the meaning of the estimated coefficient of a variable, others are assumed to remain unchanged. Price variables are influenced not only by the cost of living and travel expenses but also by the exchange rates.

Since the exchange rate affects the demand through its influence on tourists' costs of living, an allowance for this must be made when interpreting the coefficient of the exchange rate variable. This allowance may be as much as the ratio of the tourists' cost of living in the total composite price. For instance, a 1 per cent increase in the value of the Greek drachma results in an increase in tourism demand of not only 0.78 per cent as the exchange rate coefficient of Greece would indicate, but more than that, perhaps up to 1.5 per cent, after including the own price coefficient into the calculation.

The dummy variable for the political instability in Turkey in 1980 and 1981, *DV*1, has a negative coefficient for all of the countries. Tourism was negatively influenced when political violence started to climb at the end of the 1970s. In 1980, when the turmoil reached its peak, tourists avoided Turkey in large numbers. Although the military intervention, in September of that year, brought calm to the country, the demand was not expected to return soon to the normal levels of the politically stable years. Those people who were averse to military regimes stayed away for a while until the civilians came back to power. In fact, the models for Italy and the United

Kingdom gave better results with a three-year period (1980-81-82) of dummy inclusion and Greece was better with only one year (1980). However, the 1986 bombing of Libya had affected the demand for Turkish tourism only from three countries. This was the only variable with a significant coefficient in the equation of the United States.

The magnitude of the impact may be seen by focusing solely on the relevant dummy variables and comparing them with a normal year [2]. The percentage fall in demand in 1980 compared to 1979 was 64 for Greece, 46 for Switzerland, 44 for Finland, 39 for Germany, 37 for the Netherlands, 28 for Belgium and the United States, 24 for France and Italy, 18 for Austria, 15 for the United Kingdom and 13 for Sweden. Similarly, the impact of the 1986 American bombing of Libya led to a 53 per cent reduction in demand from the United States.

The supply variable shows the greatest impact on the demand. When the accommodation and transportation facilities gradually improved in the 1980s as a result of high public and private investments which started earlier, Turkey attracted steadily an increasing number of tourists from Europe. These investments not only upgraded the quality and quantity of accommodation establishments but also added new airports and motorways or improved existing ones, and this greatly facilitated access to touristic sites. It is quite obvious that more tourists would be attracted by the markedly better and faster means of transportation as well as by high quality accommodation. Eight of the eleven supply coefficients (Austria, Belgium, France, Germany, Holland, Italy, Sweden and the United Kingdom) are statistically significant at a 5 per cent level. While a 1 per cent rise in tourism investments in Turkey resulted in a 0.642 per cent increase in tourist arrivals from the United Kingdom with a two-year lag, the Greek tourists were found to be totally indifferent to the supply conditions.

The coefficients of the supply variable have to be interpreted with some caution. From the time lags between the investment on the supply facilities and the subsequent increase in tourist flows, it can be inferred that the changes in the investment level led to changes in tourist arrivals. However, at the end of the 1980s, the direction of causation was probably reversed. A questionnaire survey (Geyikdagi, 1992), which was carried out in early 1992, showed that the major motivation for investing in the Turkish tourism sector by several foreign investors was the growing number of tourist arrivals to Turkey. The direction of causation was probably running

[2] The equation of a country for 1980 is subtracted from the equation of 1979 and its antilog is taken in order to get the level of demand in 1979.

both ways and creating a causal chain at the end of the 1980s and the early years of the 1990s. Since this study does not include years beyond 1989, it should not have conceivably suffered much from the changing direction of this causal relationship. In any case, the maintenance of high standards is expected to be one of the main preoccupations of the tourism sector to sustain the demand.

In the majority of the models, the trend term was the cause of multicollinearity, having high correlation with the price variables. It was statistically significant only in the model of Finland. The coefficient of trend shows the increasing popularity of Turkish tourism in Finland, with a 21 per cent growth per year [3].

While most of the origin countries have meaningful results, with high R^2 values, the outcome of the United States shows the poorest fit. The model explains only 58 per cent of the variation in the dependent variable and has no meaningful economic coefficient at all. One of the reasons for this exceptionally poor result may be the travel warnings or advisories issued by the State Department of the United States that usually show Turkey, partly or as a whole, as a place to be avoided (for example Stroller, 1991, p. 32). Another reason may be the difficulty in modelling countries with very low per capita travel to Turkey, such as the United States.

4. *Conclusions*

The aim of this study has been to further the understanding of the behavioural aspects of tourism. Some of the demand variables affecting tourist arrivals in Turkey have been examined by using an econometric model. The supply variable (a two-year lagged fixed capital investment in tourism) which was chosen as a proxy to the progress and upgrading of the tourism product in Turkey has shown the greatest impact on the demand. The improvement of the accommodation and transportation facilities seems to have caused increases in the number of tourist arrivals. One of the leading tourist operators of the world, Touristic Union International (TUI), recently carried out a study covering 25,000 tourists who vacationed in 100 of its establishments in five countries (Spain with the Canary Islands, Italy, Greece, Tunisia and Turkey). Accordingly, its establishments in Turkey

[3] Similar to the treatment of the dummy variables, each equation was compared to that of the previous year's focusing solely on the trend term. The antilog of the difference with the previous year gives the level of demand in that year.

have received the most favourable evaluation (Türkeri, 1992, pp. 5-6). The survey, thus, establishes not only the general importance of the accommodation quality for tourists in their decision about selecting a holiday destination but also shows Turkey's excellence in this respect. While the establishments of TUI make up only a fraction of the accommodation capacity of Turkey (about 3 per cent), they are still representative of the burgeoning industry.

The income variable was found insignificant for the majority of the countries studied. Since Turkey has remained one of the least expensive destinations in the region, it continued to attract more tourists even when their incomes decreased in recessionary years and when tourist prices increased in Turkey in recent years. The relative cost of tourism vis-à-vis substitute destinations seems to be more important for tourists as the substitute price variable appears in eight of the twelve models. The dummy variable, which was to measure the effects of the political instability leading to the 1980 military intervention, was also found to be important for all of the origin countries, though at varying degrees. As the results indicate, the 1986 bombing of Libya significantly dissuaded American tourists from travelling to Turkey. The trend term appeared only in the model of Finland, showing an increasing popularity of Turkey at a rate of 21 per cent per year. Still, the demand for Turkish tourism is expected to grow as long as the high quality of the tourism product with a competitive price is maintained in a reassuringly safe political environment.

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INVESTIMENTI NELLO SVILUPPO DEL TURISMO E DOMANDA DI VIAGGI

Questo articolo esamina le determinanti della domanda di turismo in un mercato in rapido sviluppo. Nel modello econometrico qui sviluppato come variabile esplicativa è stato preso il miglioramento dello stesso prodotto turismo, oltre al reddito, al prezzo del prodotto e dei suoi sostituti, al tasso di cambio e a una coppia di variabili strumentali. Si è trovato che l'investimento di capitale fisso con lag di due anni scelto come proxy del miglioramento del prodotto turismo nel paese in esame, la Turchia, è la variabile più importante nella domanda di turismo da parte dei dodici paesi di origine. Questa variabile trascurata e tuttavia importante potrebbe d'ora innanzi essere considerata nelle analisi della domanda di turismo.

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CHANGES IN GREEK CONSUMPTION PATTERNS: THE ROLE OF COMMODITY PRICES AND BUDGET EXPENDITURE

by
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1. *Introduction*

Commodity prices and income are the main contributors of consumers' demand changes. As commodity prices and/or income change, consumers adjust their consumption patterns accordingly in order to keep maximizing their utility without violating the new budget constraint. After a change in prices, consumers reduce the quantity demanded of some goods and increase or leave unchanged that of others according to price signals. The direction of these changes is determined by the law of demand, and their magnitudes depend primarily on the characteristics of commodity demand functions, which specify consumers sensitivity to marginal changes in prices and/or income. Overall, a redistribution of consumers expenditures among commodities is achieved through these changes (see for example Silberberg, 1990). The most interesting feature though is to separate the portion of the change in quantity demanded due to changes in commodity prices from the changes in total expenditure. In theoretical grounds, the former is usually called "substitution effect" and the latter "income effect".

The main objective of this paper is to analyze changes in commodity expenditure shares in Greece from 1960 to 1991. Our emphasis is focused on the relative contribution of prices and total expenditures. Both the absolute and the relative magnitude of the total substitution and the budget (income) effect are measured through a decomposition analysis based on a

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duality approach. Quantitative measures of these effects are derived through the econometric estimates of an Almost Ideal Demand System (AIDS) (Deaton and Muellbauer, 1980a) for eight groups of commodities.

The decomposition analysis in consumer economics tries to explain the changes in commodity demand over a period of time [1]. More precisely, the over time change in the quantity for a particular good is divided into two effects: the total substitution (price) effect and the income (budget) effect. The total substitution (price) effect represents the change in the quantity demanded of a particular good due to changes in commodity prices. This part consists of changes due to own-price effect as well as to the prices of the other goods included in consumers' optimal bundle. On the other hand, the income (budget) effect corresponds to the portion of the change in the quantity demanded arising from autonomous changes in consumers' total expenditure. It should be noted that the budget effect does not include any income changes resulted from price changes, i.e. money illusion phenomenon is excluded. Decomposition analysis provides quantitative measures of the above mentioned effects and thus, it instigates new insights into explaining changes in consumption patterns.

The proposed decomposition analysis has been developed within a duality approach [2]. It is, therefore, as flexible as duality *per se* with respect to the specification of consumers' preference. That means that duality permits an econometric estimation of consumers demand functions without *a priori* knowledge of the true preference structure (Deaton and Muellbauer, 1980b; Silberberg, 1990; Varian, 1992). All available information about various elasticity estimates obtained through duality is used in decomposition analysis. In this sense, decomposition analysis can be viewed as a step further for using duality in applied microeconomics. Futhermore, decomposition analysis provides additional information about the over time change of endogenous variables, i.e. quantities demanded or consumer expenditure shares, when all exogenous variables change simultaneously. In consumer economics, decomposition analysis can be developed through either equilibrium Marshallian demand or equilibrium expenditure share functions [3].

The rest of this paper is organized as follows: in the next section, the

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[1] For a treatment of decomposition analysis in applied production economics see KAKO (1978, 1980) and KURODA (1987).

[2] Duality has also been the framework for developing decomposition analysis in applied production economics.

[3] Emphasis should be put on the word "equilibrium" since Marshallian demand and expenditure shares functions, which are obtained through duality, are valid for a particular set of commodity prices and total expenditure (VARIAN, 1992; CORNES, 1992). See also Section 2.

theoretical framework for decomposing commodity expenditure shares is developed. In the third section, the empirical model, the econometric procedure and the data set are presented. Empirical findings, including decomposition analysis results, are analyzed in the fourth section followed by concluding remarks.

2. *Theoretical Framework*

In an aggregate level, consider that a representative consumer exists and maximizes a well-defined utility function, subject to a feasible budget constraint. The existence of a representative consumer implicitly assumes that a consistent aggregation across individuals with different preferences and income levels is possible. This means that either almost all consumers have precisely identical preferences or income differences are negligible (Muellbauer, 1976). Even though these are quite unrealistic assumptions, they are necessary for an analysis at national level. In the remaining part of the paper, it is assumed that the behaviour of the representative consumer approaches that of an "average" Greek consumer and leaves outside extreme cases.

Assume that the behaviour of the representive Greek consumer is described by a well-defined expenditure function $e(p, u)$, where p and u refer to commodity prices and utility, respectively. The equilibrium expenditure shares are derived from $e(p, u)$ via Shephard's lemma, and they are a function of p and total expenditures, m (Varian, 1992; Cornes, 1992). By totally differentiating the equilibrium expenditure share of the i^{th} commodity, $s_i(p, m)$, with respect to time, it results in :

$$\frac{ds_i}{dt} = \sum_{j=1}^{n} \frac{\partial s_i}{\partial p_j} \frac{dp_j}{dt} + \frac{\partial s_i}{\partial m} \frac{dm}{dt} \tag{1}$$

Then, by dividing through by s_i and rearranging terms, it yields:

$$G(s_i) = \sum_{j=1}^{n} \frac{\partial \log s_i}{\partial \log p_j} G(p_j) + \frac{\partial \log s_i}{\partial \log m} G(m) \tag{2}$$

where $G(\cdot)$ is the growth rate of the corresponding variable.

By using the definition of expenditure share and by differentiating it once with respect to the logarithm of j^{th} commodity price and then with respect to the logarithm of total expenditure as well as by converting the derived expressions into elasticity forms, it results in:

$$\frac{\partial \log s_i}{\partial \log p_j} = \varepsilon_{ij}^M + \delta_{ij} \tag{3a}$$

and

$$\frac{\partial \log s_i}{\partial \log m} = n_i - 1 \tag{3b}$$

where δ_{ij} is the Kronecker delta ($\delta_{ij} = 1$ for $i = j$ and $\delta_{ij} = 0$ for $i \neq j$) [4]. By substituting (3a) and (3b) into (2), it yields:

$$G(s_i) = \sum_{j=1}^{n} (\varepsilon_{ij}^M + \delta_{ij})\, G(p_j) + (n_i - 1)\, G(m) \tag{4}$$

where ε_{ij}^M are the Marshallian price elasticities, and n_i is the expenditure elasticity of the i^{th} commodity. Combining (4) and Slutsky equation in elasticity form, the following relationship can be obtained:

$$G(s_i) = \sum_{j=1}^{n} (\varepsilon_{ij}^H - s_j + \delta_{ij})\, G(p_j) + (n_i - 1)\left(G(m) - \sum_{j=1}^{n} s_j\, G(p_j)\right) \tag{5}$$

or

$$G(s_i) = \sum_{j=1}^{n} (s_j(\sigma_{ij} - 1) + \delta_{ij})\, G(p_j) + (n_i - 1)\left[G(m) - \Sigma\, s_j\, G(p_j)\right] \tag{6}$$

where ε_{ij}^H are the Hicksian price elasticities, and σ_{ij} are the Hicks-Allen partial elasticities of substitution.

The left-hand side of (5) or (6) represents the percentage change in the expenditure share of the i^{th} commodity. Actually, it gives the observed percentage change of the expenditure share of the i^{th} commodity during a particular period of time. Our main task is to decompose the magnitude of this change into the price and the budget effect.

The first term, on the right-hand side of (5) or (6), refers to the total substitution (price) effect along a given indifference curve. This effect corresponds to that part of the change in the expenditure share due to price changes, and it is a weighted average of the percentage change in commodity prices with Hicksian elasticities and commodity shares as weights. The use of Hicksian elasticities ensures that this counterpart contains changes due to prices alone. The price effect is zero whether there are no substitution possibilities or, in the presence of substitutability, the share of the

[4] For a proof of (3a) see GREEN and ALSTON (1990) and for (3b) see SILBERBERG (1990, p. 340).

commodity under consideration is equal to the inverse of its own Hicks-Allen elasticity of substitution.

The second term, on the right-hand side of (5) or (6), refers to the income (budget) effect. It is a weighted proportional change in total expenditures after adjusting it for price changes with income elasticities used as weights. That is, the part that is due to price changes is subtracted from the observed proportional change in total expenses. Each price change is weighted with the expenditure share of the corresponding commodity. Namely, the term in parenthesis is a pure income change, i.e. money illusion phenomena are excluded. The second term, in (5) or (6), is zero if income elasticity of the i^{th} commodity is equal to one. This means that the income-consumption path is linear implying that consumer preferences have a homothetic structure.

In order to obtain quantitative measures of the price and the budget effects, empirical estimates of the Marshallian demand and expenditure elasticities are required. These numbers can be obtained through an econometric estimation of a complete demand system which is consistent with economic theory. In addition, the use of a flexible demand system allows for no *a priori* restrictions on the magnitude of the estimated elasticities.

3. *Empirical Model, Statistical Data and Estimation Procedure*

The empirical model used in this paper is the AIDS developed by Deaton and Muellbauer (1980a). The AIDS is a special case of PIGLOG, a more general function form for demand functions (Muellbauer, 1975). Nevertheless, the AIDS is still enough flexible to provide an arbitrary first-order approximation of any demand system, and it does not impose any *a priori* restrictions on the value of estimated parameters. Moreover, it is consistent with economic theory since it satisfies all properties of consumer preferences. It also provides consistent aggregates across both consumers and commodities and thus, it is suitable for studies like ours.

The AIDS was built up on duality. It assumes the following expenditure function:

$$\log e(p, u) = \alpha_0 + \sum_{i=1}^{n} \alpha_i \log p_i + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij}^{*} \log p_i \log p_j + u\beta_0 \prod_{i=1}^{n} p_i^{\beta_i} \quad (7)$$

where α, β and γ^{*} are parameters to be estimated, and u refers to utility. By

applying Shephard's lemma in logarithmic form, the following relationship can be obtained:

$$\frac{\partial \log e\,(p,\ u)}{\partial \log p_i} = s_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij}^{*} \log p_j + \beta_i u \beta_0 \prod_{i=1}^{n} p_i^{\beta_i} \qquad (8)$$

At any equilibrium point, total expenditure, m, is equal to the minimum cost of buying the optimal commodity bundle, $e\,(p,\ u)$. Using this, solving (7) for u and substituting it into (8), it yields:

$$s_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log (m/P) \qquad (9)$$

where $\gamma_{ij} = {}^1/_2(\gamma_{ji}^{*} + \gamma_{ji}^{*})$ and $\log (P) = \alpha_0 + \sum_{j=1}^{n} \alpha_j \log p_j + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} \log p_i \log p_j$. It is, however, common to approximate $\log (P)$ by Stone's price index, namely $\log P \approx \log P^{*} = \sum_{i=1}^{n} s_i \log p_i$.

For (7) to be a consistent expenditure function, or equivalently, for (9) to be a consistent expenditure share function, the following properties must be satisfied:

(i) $\log e\,(p,\ u)$ should be homogeneous of degree one in p and thus, s_i is homogeneous of degree zero in p. This requires that $\sum_{j=1}^{n} \gamma_{ij} = 0$;

(ii) both $\log e\,(p,\ u)$ and s_i are symmetric with respect to p. That is, $\gamma_{ij} = \gamma_{ji}$;

(iii) no violation of the budget constraint requires that expenditure shares should add up to one. This implies the following set of restrictions: $\sum_{i=1}^{n} \alpha_i = 1$, $\sum_{i=1}^{n} \beta_i = 0$ and $\sum_{i=1}^{n} \gamma_{ij} = 0$.

The estimated parameters of (9) can be used to calculate price and expenditure elasticities. A variety of approaches have been developed to calculate demand elasticities for the AIDS. Green and Alston (1990) have shown that the correct formulas for elasticity measures in AIDS are closely related to the estimated form of the AIDS. Whenever $\log (P)$ is approximated by Stone's index, the linear AIDS is estimated, instead of the true AIDS. In this case, the correct elasticity formulas in matrix form are (Green and Alston, 1990, 1991):

$$N \approx [I + BC]^{-1} B + \iota \tag{10a}$$

and

$$E = [I + BC]^{-1} [A + I] - I \tag{10b}$$

where N is a $(n \times 1)$ vector of expenditure elasticities; B is a $(n \times 1)$ vector within typical elements $b_i = \beta_i / s_i$; C is a $(1 \times n)$ vector with typical elements $C_j = s_j \log p_j$; ι is a unit vector of length n; E is a $(n \times n)$ matrix of Marshallian price elasticities, A is a $(n \times n)$ matrix with typical elements $\alpha_{ij} = \delta_{ij} + \gamma_{ij}/s_i - \beta_i s_j / s_i$; and I is an identity matrix. Using Slutsky equation in elasticity form, Hicks' compensated demand elasticities are given as:

$$H = E + NW' \tag{10c}$$

where H is $(n \times n)$ matrix of Hicksian elasticities, and W is a $(n \times 1)$ vector of expenditure shares.

Econometric estimation of equations (9) requires data on commodity prices and expenditures. For the purposes of this study, eight aggregate commodity groups are considered. These groups are food, beverages and tobacco, clothing and footwear, housing, house durables, medical care, transportation and communication and other commodities such as recreation, entertainment, education, and other services. Even though this aggregation scheme is somehow arbitrary, it has been adopted for analytical purposes. These commodity categories are considered to be the more interesting from both consumer and policy-makers viewpoints. All data are taken from the National Accounts published by NSSG (National Statistical Services of Greece). Commodity expenditures are at current prices, and prices are indices constructed by NSSG with 1980 as a base year. Total expenditure, m, consists of all commodity expenditures, and it is not equal to consumer income since savings are not taken into account.

The system of equations (9) has been estimated by using an Iterative Seemingly Unrelated Regression (ISUR) method (Zellner, 1962; Oberhofer and Kmenta, 1974; Judge et al., 1980). SUR is the most appropriate method of estimation since the system of equations (9) has been derived through an optimization problem which implies that the error terms across equations are contemporaneously correlated. This means that any decision errors associated with the i^{th} commodity affect the optimal level of all other commodities through substitutional (complementary) relationships. These interrelationships cannot be taken into account by estimating the system with OLS. Moreover, appropriate imposition of the restrictions suggested by economic theory (homogeneity, symmetry and adding-up) requires the use of SUR. Notice that symmetry cannot be imposed by using OLS. Final-

ly, it should be mentioned that ISUR estimates are equivalent to maximum likelihood regardless of the equation dropped. In our case, the equation of other commodities has been dropped.

4. *Empirical Findings*

The estimated parameters of the AIDS applied to Greek consumption data are reported in Table 1. These estimates have been obtained by impos-

TABLE 1

AI DEMAND SYSTEM WITH SYMMETRY AND HOMOGENEITY IMPOSED, GREECE, 1960-1991

	Parameters estimated									
Commodity	α_i	γ_{i1}	γ_{i2}	γ_{i3}	γ_{i4}	γ_{i5}	γ_{i6}	γ_{i7}	γ_{i8}	β_i
1. Food	0.350	0.225	-0.004	-0.108	-0.053	-0.013	-0.025	-0.010	-0.012	-0.132
	(88.44)	(4.42)	(-0.26)	(-5.13)	(-2.47)	(-0.68)	(-1.90)	(-0.39)	(-0.39)	(-8.91)
2. Beverages and	0.060		0.036	0.000	-0.011	-0.025	-0.002	-0.029	0.035	0.002
Tobacco	(45.28)		(4.38)	(0.003)	(-1.20)	(-2.96)	(-0.35)	(-3.45)	(2.76)	(0.42)
3. Clothing and	0.086			0.065	0.031	0.016	0.018	0.039	-0.061	0.020
Footwear	(50.50)			(2.79)	(2.07)	(1.17)	(1.69)	(3.16)	(-3.07)	(2.63)
4. Housing	0.119				0.085	-0.005	-0.002	-0.019	-0.026	-0.009
	(73.40)				(4.82)	(-0.42)	(0.20)	(-1.69)	(-1.72)	(-1.19)
5. Durables	0.081					0.043	0.018	-0.009	-0.026	0.000
	(54.51)					(2.84)	(2.11)	(-0.75)	(-1.81)	(0.057)
6. Medical care	0.032						-0.023	0.021	-0.004	0.013
	(29.71)						(-2.43)	(2.39)	(-0.43)	(2.74)
7. Transportation	0.127							0.003	0.004	0.044
& Communication	(51.52)							(0.14)	(0.23)	(5.80)
8. Others	0.145								0.09	0.062

- Numbers in parentheses are t-ratios.
- The estimates of the parameters without t-ratio are calculated through the imposed restrictions.

ing the properties of symmetry and homogeneity into expenditure share equations. Moreover, the adding-up restriction is *a fortiori* imposed since the expenditure share equation corresponding to all other goods has been dropped in the estimation procedure. Monotonicity and concavity of the expenditure function with respect to commodity prices hold at any sample point. Monotonicity can be checked by computing the predicted expenditure shares, which should all be positive. Given the estimated parameters, it can be shown that this holds at any sample point. On the other hand, concavity of the expenditure function requires Slutsky matrix to be negatively semi-definite. This holds as long as the own-price Hicksian elasticities are negative. The latter is assured through Slutsky's equation since all own-price Marshal-

lian elasticities are negative, and expenditure elasticities are positive (see Table 2 and 3).

The estimated coefficients a_i show how the Greek consumer allocates his expenditure among alternative commodities used at the base year. According to our results, in 1980, Greek consumers allocated their total expenditure as follows: 35% to food, 6% to beverages and tobacco, 8.6% to clothing and footwear, almost 12% to housing, 8% to housing durables, 3.2% to medical care and 12.7% to transportation and communication services. In 1975, the corresponding figures for U.K. were 31.5%, 16.4%, 6%, 10%, 2% and 10%, respectively (Muellbauer and Pashardes, 1992). According to Anderson and Blundell's (1983) result, Canadian consumers spent 34% of their total expenditure in food, beverages and tobacco, 13% in clothing and footwear and almost 15% in transportation and communication services. Definitely, these figures are not directly comparable since they refer to different years, but they provide some indications about consumers' preferences in each country.

All commodities, except food and housing (accommodation), are found to be luxuries. In the AIDS, negative b_i implies necessities while positive b_i indicates luxuries (Blanciforti and Green, 1983). Note, however, that the estimated b_i parameter for housing equation is statistically insignificant at 10% significant level. A similar reasoning holds for beverages and tobacco and house durables. Muellbauer and Pashardes (1992) found that all commodities in the U.K., except food and tobacco and beverages, are classified as luxuries during the period 1954 to 1980. On the other hand, Blanciforti and Green (1983) found that U.S. consumers faced only house durables as

TABLE 2

COMPENSATED PRICE ELASTICITIES, GREECE, 1960-1991

	Price of Commodity							
Commodity	1	2	3	4	5	6	7	8
1. Food	-0.014	0.054	-0.201	-0.024	0.044	-0.031	0.076	0.096
2. Beverages and Tobacco	0.293	-0.368	0.103	-0.046	-0.313	0.006	-0.353	0.677
3. Clothing and Footwear	-0.706	0.064	-0.257	0.435	0.240	0.214	0.490	-0.480
4. Housing	-0.065	-0.023	0.349	-0.201	0.042	0.022	-0.045	-0.080
5. Durables	0.200	-0.241	0.300	0.068	-0.392	0.258	-0.004	-0.192
6. Medical care	-0.306	0.009	0.581	0.076	0.564	-1.579	0.668	0.013
7. Transportation & Communication	0.256	-0.237	0.501	-0.068	-0.010	0.252	-0.858	0.164
8. Others	0.260	0.357	-0.415	-0.090	-0.135	0.001	0.145	-0.122

luxuries. In contrast, Canadian consumers classified transportation, communication and recreation services as luxuries (Anderson and Blundell, 1983).

The compensated (Hicksian) demand elasticities are reported in Table 2. All own-price Hicksian elasticities are, as it was expected, negative indicating a downward sloping utility-constant demand function for all commodity categories. This, furthermore, implies a negative own-price substitution effect. In addition, by using the signs of the cross-price elasticities, indications about the substitutability (complementarity) between commodities in the Hicksian sense can be obtained. As net substitutes are considered to be the following pairs of commodities: food-beverages and tobacco; food-housing durables; food-transportation and communication services; beverages and tobacco-clothing and footwear; beverages and tobacco-medical care; clothing and footwear-housing; clothing and footwear-housing durables; clothing and footwear-medical care; housing-housing durables; housing-medical care; housing durables-medical care; and medical care-transportation and communication services. All other commodity pairs exhibit a complementarity relationship. Similar substitutability relationships have been found by Muellbauer and Pashardes (1992) for the U.K. except for the pair of food and transportation and communication services.

In Table 3, the uncompensated (Marshallian) and expenditure elasticities are reported. Given that all own-price elasticities are negative, the Marshallian demand functions for all commodity groups are downward sloping. This indicates that all commodities were found to behave as normal goods. Moreover, all commodities, except medical care and transportation-communication services, were found to have an inelastic demand; that for

TABLE 3
UNCOMPENSATED PRICE AND EXPENDITURE ELASTICITIES, GREECE, 1960-1991

	Price of Commodity							
Commodity	1	2	3	4	5	6	7	8
1. Food	-0.239	0.013	-0.266	-0.105	-0.008	-0.055	0.009	0.017
2. Beverages and Tobacco	-0.074	-0.434	-0.003	-0.178	-0.397	-0.033	-0.461	0.548
3. Clothing and Footwear	-1.130	-0.013	-0.380	0.282	0.142	0.169	0.365	-0.628
4. Housing	-0.400	-0.082	0.253	-0.320	-0.034	-0.013	-0.143	-0.196
5. Durables	-0.157	-0.305	0.196	-0.060	-0.474	0.220	-0.110	-0.318
6. Medical care	-0.783	-0.076	0.443	-0.095	0.454	-1.630	0.527	-0.154
7. Transportation & Communication	-0.258	-0.329	0.352	-0.253	-0.128	0.197	-1.010	-0.017
8. Others	-0.277	0.260	-0.571	-0.283	-0.259	-0.056	-0.014	-0.310
Expenditure Elasticities	0.633	1.031	1.193	0.930	1.004	1.340	1.445	1.511

food was found the most inelastic. On the other hand, medical care was found with the most sensitive demand function. In contrast, Mergos and Donatos (1989) found that housing had the most inelastic demand followed by housing durables. Their estimates, however, were obtained without simultaneously imposing the restrictions of symmetry and homogeneity. In comparison with other countries, the own-price Marshallian elasticities for food, beverages and tobacco, and clothing and footwear were higher in Greece than in U.S. However, they were lower than those reported for U.K. and Canada. Although we found lower elasticity estimates for housing and house durables than in the above mentioned countries, the opposite is true for transportation and communication services.

The expenditure elasticities are all positive and thus, the possibility of an inferior commodity is eliminated. Moreover it is interesting to note that

TABLE 4

MARSHALLIAN OWN-PRICE AND EXPENDITURE ELASTICITIES FOR DIFFERENT COUNTRIES

Commodity	U.K. 1954-1980	U.S.A 1948-1978	India** 1952-1969	Canada 1947-1979	Greece 1960-1991
1. Food	-0.52 (0.21)	-0.21 (0.43)	-0.42 (0.35)	-0.63* (0.72)	-0.24 (0.63)
2. Beverages & Tobacco	-0.67 (0.53)	-0.08 (0.22)			-0.43 (1.03)
3. Clothing & footwear	-0.42 (1.18)	-0.24 (0.58)	-1.78 (2.30)	-0.96 (0.21)	-0.38 (1.19)
4. Housing	-0.55 (1.41)	-0.57 (1.57)			-0.32 (0.43)
5.Fuel-Light	-0.11 (1.83)	-0.38 (1.17)	-0.70 (0.57)	-0.90 (1.26)	
6. Durables	-0.33 (1.84)	-0.52 (1.39)			-0.47 (1.00)
7. Misc. Goods	-0.37 (0.82)	-0.22 (0.62)	-0.95 (2.21)	-0.90 (1.45)	-0.31 (1.51)
8. Misc. Services	-0.81 (1.32)	-0.36 (0.96)			
9.Transport & Communications	-0.80 (1.08)	-0.38 (1.09)		-0.82 (1.25)	-1.01 (1.45)
10. Medical Care		-0.61 (1.99)			-1.63 (1.34)

The numbers in parentheses represent expenditure elasticities.

* Included Food, Beverages and Tobacco.

** Urban areas.

two income elasticities (that of beverages and tobacco and housing durables) are almost equal to one. In terms of income sensitivity, medical care and transportation and communication services were found to be the most elastic whereas food is the least elastic. Food and housing are the only expenditure inelastic commodity categories as suggested by Engel's and Schwabe's laws, respectively (Brown and Deaton, 1972). Similar results were also obtained by Mergos and Donatos (1989). Food expenditure elasticity in Greece is higher than both U.K. (0.21) and U.S.A. (0.43) whereas the opposite is true for housing and house durables (see Table 4). For clothing and footwear, U.K. and Greece have similar expenditure elasticities, which are by far higher than those of the U.S. and Canada. Finally, the estimates for transportation and communication services as well as medical care are quite similar in Greece, U.K., U.S.A., and Canada.

The decomposition results are reported in Table 5. The expenditure

TABLE 5

DECOMPOSITION ANALYSIS OF EQUILIBRIUM EXPENDITURE SHARES, GREECE, 1960-1991

Commodity	Annual Observed Change in Expenditure Share	Total Price (Substitution) Effect	Budget Effect
1. Food	-0.0109	0.0054	-0.0163
	(100%)	(-49.54%)	(149.54%)
2. Beverages and Tobacco	0.0059	0.0045	0.0014
	(100%)	(76.27%)	(23.73%)
3. Clothing and Footwear	-0.0038	-0.0124	0.0086
	(100%)	(326.31%)	(-226.31)
4. Housing	-0.0052	-0.0021	-0.0031
	(100%)	(40.38%)	(59.62%)
5. Durables	0.0004	0.0002	0.0002
	(100%)	(50.00%)	(50.00%)
6. Medical care	-0.0007	-0.0158	0.0151
	(100%)	(2257.14%)	(-2157.14%)
7. Transportation & Communication	0.0307	0.0109	0.0198
	(100%)	(35.50%)	(64.50%)
8. Others	0.0193	-0.0034	0.0227
	(100%)	(-17.62%)	(117.62%)

shares of food, clothing and footwear, housing, and medical care exhibited an annual rate of decrease of 1.1%, 0.4%, 0.5% and 0.1%, respectively. In contrast, the expenditure shares of beverages and tobacco, house durables, and transportation and communication services increased annually by 0.6%, 0.04% and 3.1%, respectively. Thus, expenditure shares changed at really slow rates during the period from 1960 to 1980 except those of transportation and communication services and food. We faced a tremendous annual increase of the former and a steady, slow decrease of the latter.

There are four cases where the total price and the budget effect have moved in the same direction and simultaneously have determined a change in the corresponding expenditure share. This is true for beverages and tobacco, housing, housing durables and transportation and communication services. In two out of four cases (housing, and transportation-communication), the contribution of the budget effect is relatively stronger than that of the total price effect. On the other hand for both, clothing-footwear, and medical care, the total price and the budget effects have moved in the opposite direction to each other. In both cases, however, the total price effect was stronger and determined the direction of change of the corresponding expenditure shares.

According to our results, the decrease in the expenditure share of food was mainly due to the budget effect. This means that as autonomous changes in total expenditure occurred, Greek consumers preferred to decrease expenditure for food both in absolute and relative terms. This consequently resulted in a decrease of the food expenditure share. In contrast, the total price (substitution) effect was positive and favored the increase of food expenditure shares. In relative terms, the price of food had become cheaper although the budget effect was strong enough to offset the positive total price effect.

Almost three-quarters of the annual increase in the expenditure share of beverages and tobacco can be explained by the total substitution effect, which was positive. This means that its relative price decreased even in the presence of taxes in cigarettes and alcoholic beverages. Thus, commodity price changes seem to be more important for this commodity category than changes in total expenditures during the period under question. However, it should be mentioned that both effects have favoured the increase of its expenditure shares.

In the case of clothing and footwear, the situation was different: changes in total spending favored the increase of its share, but prices tried to remove this trend. The relative price of clothing and footwear has increased, and this induced a decrease of its share in total expenditure. More-

over, this decrease could not be offset by the positive budget effect.

The budget effect was the main contribution of the observed decrease in housing expenditure share. The total price (substitution) effect moved in the same direction and contributed for around 40% in this change. Thus, the relative price of housing services increased during the period under question, and Greek consumers allocated less and less of their autonomous changes in total spending to housing services.

In contrast, the expenditure share of house durables increased. This increase is equally shared by the total price and the budget effect. Thus, both relative price and total expenditure changes favored the increase of house durables. Greek consumers reallocated the expenditures for housing and its equipment in favor of the latter. They preferred to spend less for housing, but they tried to improve the environment they lived in and expanded the facilities provided by house durables. This can be considered as one of the most interesting features of the period under consideration.

Surprisingly, Greek consumers' expenditure share for medical care was reduced mainly due to price changes. The relative price of medical care services increased, and this change was strong enough to offset the positive expenditure effect associated with it. Thus, even though there was a trend for increasing medical care services as changes in total spending occurred, the simultaneous increase in the price of these services did not allow for a reallocation of spending in favor of medical care.

The tremendous annual increase of the transportation and communication expenditure share was mainly due to the budget effect which accounted for almost two-thirds of this change. The rest was attributed to the total price (substitution) effect. The relative price of transportation and communication services was reduced. Also much of the change in the total spending was allocated to these services. This phenomenon also occurred in other developed and developing countries, and it was related to changes in the quality of transportation and communication services as well as to the overall economic growth.

7. *Concluding Remarks*

During the period from 1960 to 1991, Greek consumption patterns were characterized by divergent paths of changes: the expenditure shares of food, clothing and footwear, housing and medical care declined while those of all other commodity categories considered in this study increased. More interestingly, the relative contribution of the price and the budget effect on

these changes are differentiated across commodity groups. Furthermore, both effects did not always have the same direction. The magnitude of the relative contribution of each one depends on the magnitude of the observed change in the exogenous variables (commodity prices and expenditures) and the demand sensitivity on those changes (i.e. elasticities).

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VARIAZIONI NEI MODELLI DI CONSUMO IN GRECIA: IL RUOLO DEI PREZZI DELLE MERCI E DELLA SPESA DI BILANCIO

Questo articolo presenta delle misure quantitative degli effetti di reddito e di sostituzione totale per otto gruppi merceologici. Queste misure sono state calcolate per la Grecia dal 1960 al 1990. Secondo i risultati dell'articolo entrambi questi effetti sono significativi nel determinare le variazioni nel tempo delle quote di spesa. Inoltre, essi non hanno sempre la stessa direzione. Per vitto, alloggio e servizi di trasporto e comunicazione l'effetto di reddito sembra essere relativamente più forte mentre per bibite, tabacco, abbigliamento e calzature, beni durevoli per la casa e cure mediche sono soprattutto le variazioni dei prezzi che determinano i cambiamenti delle quote di spesa.

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LA RIPARTIZIONE DEL MERCATO FRA MARCHE RIVALI

di
CARLO CARLI *

1. *Il problema*

È universalmente affermato da parte dei marketing manager, e segnatamente da coloro che operano nei settori « consumer », come il volume delle vendite dipenda principalmente dai classici quattro fattori che compongono ciò che in gergo viene definito « marketing-mix »: il prodotto, il prezzo, la pubblicità (con la promozione ad essa assimilabile), la distribuzione.

Tuttavia va notato come l'affermazione suddetta non vada oltre la dichiarazione di un generico rapporto fra causa ed effetto, astenendosi dall'indicare il tipo di funzione interpretativa ed esplicativa, il grado di precisione e di significatività, le misure delle variabili in gioco.

Il problema che si è voluto affrontare è proprio quello di definire un modello matematico-statistico in grado di rispondere a due quesiti principali circa la ripartizione del mercato fra marche rivali:

a) quali risultati di vendita si possono conseguire impiegando prefissate dosi di fattori di marketing?

b) quali dosi di fattori si debbono mettere in campo dovendo conseguire prefissati obiettivi di vendita?

2. *La soluzione del problema*

È stato accertato, dopo controllati esperimenti condotti in molti settori « consumer », che la funzione statistica in grado di spiegare la relazione fra i fattori del marketing-mix e le vendite è una regressione multipla lineare, avente un coefficiente di correlazione mediamente pari a 0.94.

* Università degli Studi di Parma, Laboratorio di Marketing, Parma.

La funzione assume la seguente connotazione:

$$QM = a * BS + b * IC + c * PR + d * QD + e * QP + k$$

i cui simboli posseggono i significati sotto elencati.

QM = Quote di mercato di marca, intese come rapporto percentuale fra le quantità vendute da una data marca e quelle vendute da tutte le marche operanti sul mercato.

BS = Budget di settore, ottenuto sommando i budget pubblicitari di tutte le marche rivali. È chiaro come tale fattore debba essere espresso in lire costanti.

IC = Indice di concentrazione del settore, calcolato sommando le tre maggiori quote di mercato. Evidentemente si tratta di un valore percentuale.

PR = Prezzo relativo di marca, calcolato rapportando al prezzo medio del mercato – posto uguale a cento – il prezzo di ciascuna marca.

QD = Quota distributiva ponderata, quale rapporto percentuale fra il giro d'affari (di quel dato prodotto) nei punti di vendita in cui è presente quella data marca e l'intero giro d'affari (sempre di quel dato prodotto) in tutti i punti di vendita.

QP = Quota pubblicitaria di marca, ricavata rapportando – percentualmente – il budget di ogni marca dall'intero budget di settore.

k = Termine stocastico.

a, b, c, d, e = coefficienti della regressione.

I settori merceologici in cui sono state ricercate e reperite le funzioni di regressione multipla lineare del tipo suddetto (e intorno ai quali si sono sviluppati i processi di simulazione) sono circa una trentina. Nel prospetto seguente essi sono elencati con a fianco l'indicazione del corrispondente coefficiente di correlazione multipla lineare [1].

[1] La funzione, vagliata ai test di significatività, presenta i valori di F sempre decisamente superiori ai limiti critici più elevati (99%), ovviamente se le serie dei dati superano un minimo di numerosità (20-25). Anche i valori di t si dimostrano sempre superiori ai limiti critici più elevati se riferiti ai coefficienti relativi alle variabili di marca (prezzo relativo, quota pubblicitaria, quota distributiva ponderata), mentre per i due coefficienti di settore (budget di settore, indice di concentrazione) i valori di t superano i limiti critici suddetti soltanto quando le serie dei dati trattati abbracciano un ampio arco di tempo (anni o bimestri) e presentano una congrua variabilità.

La funzione logistica è risultata quella che meglio descrive le relazioni fra le coppie delle variabili di marca: QP e QD, QP e QM, QD e QM. Anche questa funzione, al vaglio dei test di significatività, presenta valori di R e di F sempre superiori ai valori critici più elevati (99%). Le relazioni fra la variabile prezzo e le altre variabili di marca sono invece descritte da funzioni di diversa forma, anche se prevalentemente di tipo lineare e di varia significatività.

Settore	C.C.M.	Settore	C.C.M.	Settore	C.C.M.
Abbronzanti	0,98	Fuori pasto	0,96	Precucinati	0,95
Balsami per capelli	0,89	Gelati in vaschetta	0,99	Preparati per budini	0,85
Brandy	0,93	Insetticidi (piastrine)	0,89	Prosciutto cotto	0,98
Caffè	0,94	Latte UHT	0,97	Prosciutto crudo	1,00
Camomilla	0,95	Olio oliva e.v.	0,91	Riso	0,90
Dadi per brodo	0,97	Olio oliva normale	0,84	Shampoo	0,87
Dentifrici	0,94	Pannolini bambini	0,98	Succhi frutta	0,96
Detersivi concentrati	0,83	Passate pomodoro	0,90	Tè	0,98
Detersivi normali	0,95	Pesci surgelati	0,99	Vegetali surgelati	0,96
Formaggio grana	1,00	Petfood	0,96	Whisky	0,92
Frollini	0,96				

Può essere interessante sapere come si è pervenuti alla identificazione della funzione suddetta. Il tutto ha preso l'avvio nel periodo a cavallo degli anni 70-80, allorché il trattamento di 705 coppie di dati, analogo a quello effettuato negli USA da Peckham (1969), permise di accertare una prima relazione fra quote pubblicitarie e quote di mercato.

Detta relazione è costituita da una semplice funzione logistica avente – mediamente – un coefficiente di correlazione non inferiore a 0.80.

Inoltre gli esperimenti suddetti permisero d'accertare che il rapporto tra quote pubblicitarie e quote di mercato « *QP/QM* » (in cui le *QM* sono riferite a quantità) risente in modo significativo dell'influenza di due fattori ambientali: la reclamizzazione (*BS*) e la concentrazione (*IC*) del settore.

Ciò nel senso che nei settori molto reclamizzati e molto concentrati l'intercetta e l'asintoto si allontanano, mentre nei settori poco reclamizzati e poco concentrati si verifica esattamente l'opposto dando origine, rispettivamente, a curve molto ripide e a curve di limitata pendenza.

Giunti a questo punto è sorta spontanea la ricerca di una funzione avente un più elevato coefficiente di correlazione, attraverso l'inclusione fra le variabili indipendenti di due altri importanti fattori: la quota distributiva (*QD*) e il prezzo relativo (*PR*) in aggiunta a tutti i fattori (di marca e di ambiente) sin qui citati. Si è pervenuti così alla determinazione della funzione di regressione multipla lineare più sopra illustrata.

È pure interessante sapere che anche altri ricercatori si sono posti alla ricerca di una funzione esplicativa fra fattori del marketing mix e le vendite, percorrendo strade molto simili e conseguendo risultati analoghi a quelli più sopra messi in evidenza (Carli e Zaghi, 1994).

A questo punto appare superfluo far osservare come utilizzando la funzione di regressione multipla lineare è possibile definire, mediante tentati-

vi sistematici, gli effetti (cioè le *QM*) ottenibili con variabili dosi e variabili combinazioni di fattori del marketing-mix.

3. *Fonti e trattamento dei dati*

Le fonti dei dati utilizzati sono costituite dalle normali rilevazioni di shop-audit della Nielsen e dai servizi di censimento pubblicitario della stessa società (servizio NASA).

È bene osservare che i dati suddetti sono, di norma, abitualmente in possesso delle imprese operanti nei diversi settori, grazie a un diffuso contratto di abbonamento.

Tali dati sono stati ovviamente oggetto di appropriati trattamenti, suddivisi nelle tre principali fasi sotto descritte:

a) *preliminare*, finalizzato alla costruzione delle matrici di base;

b) *statistico*, finalizzato alla identificazione di funzioni e di correlazioni;

c) *simulazioni*, finalizzato alla formulazione di previsioni sull'esito di ipotizzate combinazioni dei fattori del marketing mix.

Il trattamento preliminare dei dati comprende un normale processo di deflazionamento e di destagionalizzazione dei valori monetari che attengono all'area pubblicitaria e la loro trasformazione in dati percentuali, nonché la trasformazione dei prezzi assoluti in prezzi relativi.

Il trattamento si conclude con la costruzione di tre matrici di dati: la prima che comprende anche l'aggregato costituito dalle « Altre Marche »; la seconda che esclude, di norma, detto aggregato e i dati delle marche in lancio; la terza in cui sono comprese, per tutti i periodi esaminati, soltanto le quote di mercato delle singole marche e delle Altre Marche con i rispettivi budget di settore (*BS*).

Ovviamente si auspica che l'aggregato delle Altre Marche possa essere fornito dall'attuale società rilevatrice suddiviso in tre gruppi (specialmente a proposito della *QD*): altre marche industriali, altre marche commerciali, budget brands.

Il trattamento statistico riguarda sostanzialmente le due ultime matrici: la seconda, dedicata al calcolo delle funzioni che legano le singole variabili sia fra loro sia con le vendite; la terza, dedicata al calcolo delle correlazioni fra le *QM* delle marche concorrenti e la relazione fra *BS* e la *QM* delle Altre Marche.

Le simulazioni non sono altro che applicazioni delle funzioni di regressione multipla lineare attribuendo alle variabili indipendenti gamme di valo-

ri opportunamente scelti. In altre parole si calcolano le quote di mercato che si possono ottenere variando opportunamente la combinazione dei fattori di marketing di marca (segnatamente il prezzo e il budget pubblicitario) e d'ambiente.

È chiaro che nel far ciò si risponde ai quesiti sub a) e sub b) del primo paragrafo, come dovevasi dimostrare.

Sembra superfluo informare che l'effettuazione dei trattamenti suddetti diviene abbastanza agevole mediante un particolare software – denominato Marketing-Mix – appositamente realizzato dallo scrivente in cooperazione col dott. Alberto Zaghi, matematico e informatico collaboratore del Laboratorio di Marketing di Parma (Carli e Zaghi, 1994).

4. *Analisi critica*

Il modello sopra descritto non è certamente completo e non è certamente immune da critiche. Tuttavia esso costituisce quanto è consentito dall'attuale disponibilità dei dati e dalle elaborazioni conseguenti. Fra le non poche critiche devono essere citate, in modo particolare, quelle riguardanti i temi seguenti.

La qualità del prodotto: per qualità del prodotto si deve intendere quella soggettivamente intesa (percepita o attribuita). Tale dato manca dalla funzione poiché non è ancora oggetto di *syndicate survey* analoghe agli *shop-audit*.

Gli effetti della pubblicità: attualmente nella funzione sono immessi dati sugli investimenti pubblicitari che lamentano evidenti lacune. Per esempio: il limitato paniere dei media analizzati; i prezzi di listino della pubblicità variamente distanti da quelli praticati; la qualità della pubblicità; gli errori di pianificazione dei media e di programmazione temporale; la cumulazione degli effetti delle campagne pubblicitarie pregresse; le promozioni e le sponsorizzazioni.

Per colmare le lacune suddette basterebbe rilevare periodicamente – mediante apposita *syndicate survey* – il dato riguardante la notorietà-immagine delle diverse marche. Infatti tale dato consentirebbe di superare le lacune elencate poiché in esso si riassume l'effetto finale delle campagne pubblicitarie comunque eseguite.

La regressione multipla lineare: allo stato presente delle esperienze questa funzione si è dimostrata adatta, ma è probabile che una vasta disponibilità di dati storici possa condurre a una più idonea regressione multipla di tipo non lineare.

Occorre infine informare che lo scrivente ha messo a punto un modello di rilevazione *syndicate survey* concernente la qualità del prodotto e la notorietà delle marche, attraverso una congrua sperimentazione dall'esito confortante. È chiaro che la sua implementazione dipende dal finanziamento da parte delle imprese, che a sua volta dipende dal grado di convincimento dei rispettivi marketing manager circa la possibilità di definire le politiche di marketing attraverso precisi calcoli razionali.

Inoltre si può utilizzare il modello di Goodman (impiegato per accertare i flussi degli elettori fra i partiti, trattando i risultati aggregati di due successive votazioni) per definire i flussi dei consumatori fra marche concorrenti (Carli e Zaghi, 1994). Cosa questa ora possibile soltanto mediante le rilevazioni riguardanti i consumatori.

5. *Conclusioni*

La ripartizione del mercato fra marche rivali è il risultato delle politiche di marketing messe in atto dalle singole imprese che si contendono i consumatori. A loro volta le singole politiche di marketing altro non sono che l'implementazione di quelle combinazioni dei fattori del marketing-mix decise da ciascun manager che le ha ritenute ottimali.

Lo strumento razionale che consente al marketing manager di definire il marketing mix ottimale, come illustrato in precedenza, è costituito dai calcoli (simulazioni) basati sulla regressione lineare multipla.

I dati necessari per i calcoli sopra richiamati non presentano alcun costo aggiuntivo per le imprese, in quanto rientranti nelle normali forniture in abbonamento. Vi saranno certamente costi aggiuntivi in connessione alle rilevazioni periodiche sulla qualità del prodotto e sulla notorietà-immagine delle marche.

Lo strumento suddetto può considerarsi validato in forza delle seguenti argomentazioni:

a) il confronto fra dati calcolati con la funzione interpolante e i dati rilevati dimostra un felice adattamento. E ciò vale per le serie dei dati interpolati e per le serie dei dati estrapolati;

b) le applicazioni operative sin qui svolte hanno dimostrato la correttezza dei dati simulati. In particolare si segnala la correttezza della definizione sia dei prezzi sia del budget pubblicitario.

Occorre peraltro informare che il modello descritto non trova un'entusiastica accoglienza presso la generalità dei manager, sia perché essi non ritengono possibile definire in modo razionale ciò che è sempre stato affida-

to all'arte e all'esperienza individuale degli operatori, sia perché probabilmente temono una *diminutio capitis*.

Ad ogni buon conto occorre ricordare come il proseguimento degli studi potrebbe portare a risultati migliori di quelli già acquisiti, soprattutto se potranno fondarsi su una più estesa e più completa serie di dati di mercato.

RIFERIMENTI BIBLIOGRAFICI

CARLI C. e ZAGHI A., *Il modello Marketing-Mix*, Parma: Ediprima-Azzali, 1994.

PECKHAM James O., « Can we Relate Advertising Dollars to Market Share Objectives? », in M.A. McNiven, ed., *How Much to Spend in Advertising?*, New York: A.N.A., 1969.

MARKET BREAKDOWN AMONG RIVAL BRANDS

We have found that in consumer mass markets there exists a precise relationship between elements of the marketing mix and market shares. This relationship consists of a multiple linear regression having a correlation coefficient of 0.95 on the average. Such a function has been experimented positively in all 30 consumer fields where it was tested.

The data used were those of "Nielsen Retail Index", and these are easily available in marketing oriented firms.

On the basis of these data and functions it was possible to create a sofware (called Marketing-Mix) which enables us to perform many "simulations" aimed at finding the best combinations of those elements when making up a marketing mix and giving firms the possibility to attain greater market shares or simply more convenient ones. This software is extremely easy to use and becomes a tool for marketers after only a very short training period (a few hours).

[illegible]

RIFERIMENTI BIBLIOGRAFICI

[illegible]

Dickman James D., «[illegible]» [illegible]

[illegible]

The data used were [illegible]

On the basis of these data and [illegible]

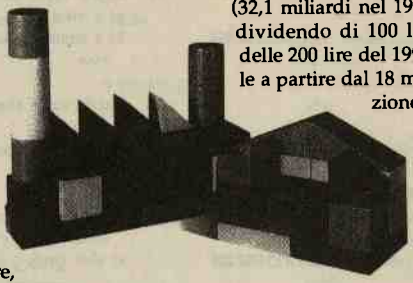
[illegible]

a) il confronto fra dati calcolati [illegible] e i dati rilevati [illegible]

b) le applicazioni [illegible]

[illegible]

FONSPA BILANCIO 1994



Si è tenuta a Roma, giovedì 20 aprile, l'Assemblea degli Azionisti del Credito Fondiario e Industriale - FONSPA - Spa, che ha approvato il Bilancio al 31 dicembre 1994.

Il passato esercizio è stato caratterizzato da una difficile situazione di mercato, in particolare nel settore immobiliare, che ha comportato il perdurare di una debole domanda di finanziamenti e, da parte dell'Istituto, un'attenta politica di selezione e controllo dei rischi creditizi.

Sono state stipulate nuove operazioni per 1.480,8 miliardi (1.636,1 miliardi nel 1993).

A fine esercizio i crediti verso la clientela erano pari a 11.781,0 miliardi (+1,7% rispetto alla fine del '93).

Il margine di interesse è stato pari a 311,2 miliardi (-7,7% rispetto al '93), in relazione sia alla riduzione degli spreads che alla contenuta dinamica degli impieghi.

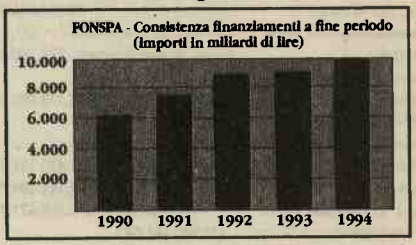
E' stata ulteriormente accentuata la prudenziale politica negli accantonamenti a fronte dei rischi creditizi, che hanno inciso sul conto economico per 214,8 miliardi, contro i 185,4 del 1993.

In particolare, oltre ad avere effettuato accantonamenti in sospensione di imposta nella misura massima consentita, è stato effettuato un ulteriore accantonamento supplementare tassato.

L'utile prima delle imposte è risultato pari a 39,3 miliardi (84,5 miliardi nel precedente esercizio).L'utile netto è stato di 13,4 miliardi (32,1 miliardi nel 1993). Verrà distribuito un dividendo di 100 lire per azione, a fronte delle 200 lire del 1993; lo stesso sarà pagabile a partire dal 18 maggio 1995, su presentazione dei certificati azionari, ai sensi delle disposizioni di legge, presso la Banca Commerciale Italiana, il Credito Italiano, la Banca di Roma e le altre consuete Casse incaricate, nonché presso la Monte Titoli Spa (per i titoli dalla stessa amministrati) e la Sede sociale dell'Istituto.

L'Assemblea ha provveduto altresì ad integrare il Consiglio di Amministrazione nominando consigliere il sig. Antonio Masala, già cooptato nel corso del 1994.

Il Consiglio di Amministrazione ha poi confermato nella carica di Presidente Mario Piovano. Amministratore Delegato è Antonio Masala.



La documentazione di cui alla delibera CONSOB n. 5553 del 14.11.1991 è depositata presso la Sede sociale, Via Cristoforo Colombo, 80 e presso il Consiglio di Borsa di Milano e le altre Sedi.

Copia della stessa verrà inviata a chiunque ne faccia richiesta.

ISTITUTO CENTRALE DI BANCHE E BANCHIERI

Sede Sociale e Direzione Generale: Milano, Corso Monforte, 34

STATO PATRIMONIALE AL 31 DICEMBRE 1994

ATTIVO

		Lire	Lire
10.	Cassa e disponibilità presso banche centrali e uffici postali		1.404.726.866
20.	Titoli del Tesoro e valori assimilati ammissibili al rifinanziamento presso banche centrali		585.688.818.569
30.	Crediti verso banche:		2.295.927.484.268
	a) a vista	463.259.827.122	
	b) altri crediti	1.832.667.657.146	
40.	Crediti verso clientela		251.135.242.207
50.	Obbligazioni e altri titoli di debito:		1.601.765.069.354
	a) di emittenti pubblici	1.471.806.456.111	
	b) di banche	129.893.835.674	
	c) di enti finanziari	2.252.250	
	d) di altri emittenti	62.525.319	
60.	Azioni, quote e altri titoli di capitale		154.340.216
70.	Partecipazioni		90.478.412.731
80.	Partecipazioni in imprese del Gruppo		39.836.646.400
90.	Immobilizzazioni immateriali		272.760.813
100.	Immobilizzazioni materiali		117.378.692.888
120.	Azioni o quote proprie (Valore Nominale 500.065.000)		1.470.191.100
130.	Altre attività		192.241.294.553
140.	Ratei e risconti attivi:		106.109.671.718
	a) ratei attivi	105.940.181.043	
	b) risconti attivi	169.490.675	
	Totale dell'Attivo		**5.283.863.351.683**

PASSIVO

		Lire	Lire
10.	Debiti verso banche:		4.447.196.705.725
	a) a vista	456.246.936.115	
	b) a termine o con preavviso	3.990.949.770.610	
20.	Debiti verso clientela		79.288.965.711
	a) a vista	69.192.065.536	
	b) a termine o con preavviso	10.096.900.175	
30.	Debiti rappresentati da titoli:		126.396.818.118
	a) altri titoli	126.396.818.118	
50.	Altre passività		135.180.059.365
60.	Ratei e risconti passivi:		84.370.034.855
	a) ratei passivi	84.291.019.499	
	b) risconti passivi	79.015.356	
70.	Trattamento di fine rapporto di lavoro subordinato		5.493.990.639
80.	Fondi per rischi ed oneri:		21.234.703.981
	b) fondi imposte e tasse	20.084.703.981	
	c) altri fondi	1.150.000.000	
100.	Fondo per rischi bancari generali		8.500.000.000
120.	Capitale	95.000.000.000	
130.	Sovrapprezzi di emissione		6.596.015.000
140.	Riserve:		180.322.071.955
	a) riserva legale	55.330.051.711	
	b) riserva per azioni o quote proprie	1.470.191.100	
	d) altre riserve	123.521.829.144	
150.	Riserve di rivalutazione		83.378.856.235
170.	Utile d'esercizio		10.905.129.099
	Totale del Passivo		**5.283.863.351.683**

	Garanzie e impegni		
10.	Garanzie Rilasciate		37.170.843.664
	di cui:		
	– accettazioni	1.497.509.193	
	– altre garanzie	35.673.334.471	
20.	Impegni		451.394.645.461

Istituto Italiano di Credito Fondiario

SOCIETÀ PER AZIONI - SEDE IN ROMA - CAPITALE L. 108.000.000.000

BILANCIO D'IMPRESA – STATO PATRIMONIALE AL 31 DICEMBRE 1994

ATTIVO

		Lire	Lire
10.	Cassa e disponibilità presso banche centrali e uffici postali		9.850.535.223
20.	Titoli del Tesoro e valori assimilati ammissibili al rifinanziamento presso banche centrali		10.265.293.180
30.	Crediti verso banche:		295.140.801.016
	a) a vista	294.847.944.294	
	b) altri crediti	292.856.722	
40.	Crediti verso clientela		8.497.685.259.499
50.	Obbligazioni e altri titoli di debito:		8.266.230.278
	a) di emittenti pubblici	—	
	b) di banche	8.266.230.278	
	di cui:		
	– titoli propri	*8.266.230.278*	
70.	Partecipazioni		26.103.491.713
	di cui:		
	– valutate al patrimonio netto	13.113.517.528	
	– altre	12.989.974.185	
80.	Partecipazioni in imprese del gruppo		51.473.752.967
	di cui:		
	– valutate al patrimonio netto	51.473.752.967	
90.	Immobilizzazioni immateriali		1.966.582.486
100.	Immobilizzazioni materiali		256.786.488.800
130.	Altre attività		100.134.316.058
140.	Ratei e risconti attivi:		92.415.195.385
	a) ratei attivi	2.875.895.183	
	b) risconti attivi	89.539.300.202	
	di cui:		
	– disaggio di emissione su titoli	*47.142.664.480*	
	Totale dell'Attivo		**9.350.087.946.605**

PASSIVO

		Lire	Lire
10.	Debiti verso banche:		1.580.060.122.133
	a) a vista	—	
	b) a termine o con preavviso	1.580.060.122.133	
20.	Debiti verso clientela		31.558.118.464
	a) a vista	—	
	b) a termine o con preavviso	31.558.118.464	
30.	Debiti rappresentati da titoli:		6.504.060.817.248
	a) obbligazioni	6.079.616.868.521	
	b) certificati di deposito	155.230.000.000	
	c) altri titoli	269.213.948.727	
40.	Fondi di terzi in amministrazione		4.013
50.	Altre passività		148.579.162.441
60.	Ratei e risconti passivi:		139.882.756.414
	a) ratei passivi	137.001.581.393	
	b) risconti passivi	2.881.175.021	
70.	Trattamento di fine rapporto di lavoro subordinato		14.459.041.955
80.	Fondi per rischi ed oneri:		26.898.820.573
	a) fondi di quiescenza e per obblighi simili	—	
	b) fondi imposte e tasse	21.402.632.000	
	c) altri fondi	5.496.188.573	
90.	Fondi rischi su crediti		104.331.866.417
100.	Fondo per rischi bancari generali		140.000.000.000
120.	Capitale		108.000.000.000
140.	Riserve:		375.446.688.135
	a) riserva legale	317.322.471.868	
	b) riserva per azioni o quote proprie	—	
	c) riserva statutaria	51.262.488.621	
	d) altre riserve	6.861.727.646	
150.	Riserve di rivalutazione		164.635.608.085
170.	Utile d'esercizio		12.174.940.727
	Totale del Passivo		**9.350.087.946.605**
	Garanzie e impegni		
20.	Impegni		1.702.873.790.283

Fondazione Marco Fodella

Via Meravigli 18
20123 Milano
C.F. 97164850154

Borse di studio della Fondazione Marco Fodella

Allo scopo di promuovere la conoscenza della musica antica la Fondazione Marco Fodella (*) istituisce borse di studio per i corsi di liuto, altri strumenti e canto offerti dalla Sezione Musica Antica della Civica Scuola di Musica di Milano.

Tali corsi (con i rispettivi docenti) sono: **Arpa** (Mara Galassi), **Canto** (Cristina Miatello), **Clavicembalo** e **Fortepiano** (Laura Alvini), **Flauto diritto** (Pedro Memelsdorff), **Flauto traverso** (Ezequiel Recondo), **Liuto** (Paul Beier), **Oboe barocco** (Paolo Grazzi), **Organo barocco** (Lorenzo Ghielmi), **Tromba naturale** (Gabriele Cassone), **Viola da gamba** e **Violoncello barocco** (Roberto Gini), **Violino barocco** (Enrico Gatti e Donella Terenzio), **Violone** (Paolo Rizzi).

Le borse di studio (una delle quali è vincolata allo strumento di Marco, il liuto) consistono in:
1) iscrizione alla Civica Scuola di Musica
2) alloggio in Milano.
Per informazioni dettagliate e la presentazione delle domande (da far pervenire entro il 31 marzo 1996) rivolgersi a: "***Borse di studio della Fondazione Marco Fodella***"
c/o Civica Scuola di Musica di Milano, Sezione di Musica Antica, Villa Simonetta, Via Stilicone 36, 20154 Milano fax (02) 331 5697 tel 313 334 oppure 3310 1259 (ore 15~18)

Concerti della Fondazione Marco Fodella

Allo scopo di diffondere la conoscenza della musica antica la Fondazione Marco Fodella (*) annuncia i seguenti concerti che si terranno nella Basilica di San Marco, Sacrestia Monumentale (Milano, Piazza San Marco, 2):

Giovedì 19 ottobre 1995 ore 21 "Allegrezza del nuovo maggio"
musiche di Biagio Marini, Ensemble Galilei diretto da Paul Beier
Emanuela Galli *soprano*

Venerdì 20 ottobre 1995 ore 21
recital di liuto: musiche di Gautier, Mouton, Weiss
Franco Pavan *liuto barocco*

Sabato 21 ottobre 1995 ore 21
recital di liuto: musiche di Bach, Weiss, Logy, Reusner
Anthony Bailes *liuto barocco*

La **Civica Scuola di Musica** annuncia il concerto per ricordare Marco che verrà eseguito presso la propria sede nell'Auditorium di Villa Simonetta:

Martedì 14 novembre 1995 ore 19

(*) Fondazione Marco Fodella
La Fondazione ha lo scopo di promuovere e continuare nel nome di Marco le attività culturali, sociali e umanitarie che ne hanno caratterizzato l'intensa vita. Tra queste: la conoscenza della musica antica attraverso l'erogazione di borse di studio per la Civica Scuola di Musica di Milano (Sezione di Musica Antica), l'organizzazione di concerti e manifestazioni culturali in genere, la cura e l'edizione di dischi e pubblicazioni specializzate, la promozione di studi e ricerche; l'attività di assistenza umanitaria; l'attività diretta ai giovani; e ogni altra iniziativa appropriata allo spirito che anima la Fondazione e idonea a perseguirne gli scopi. A questo fine si terrà particolarmente conto delle proposte formulate da chi abbia conosciuto e amato Marco o suggerite dalle caratteristiche della sua personalità.

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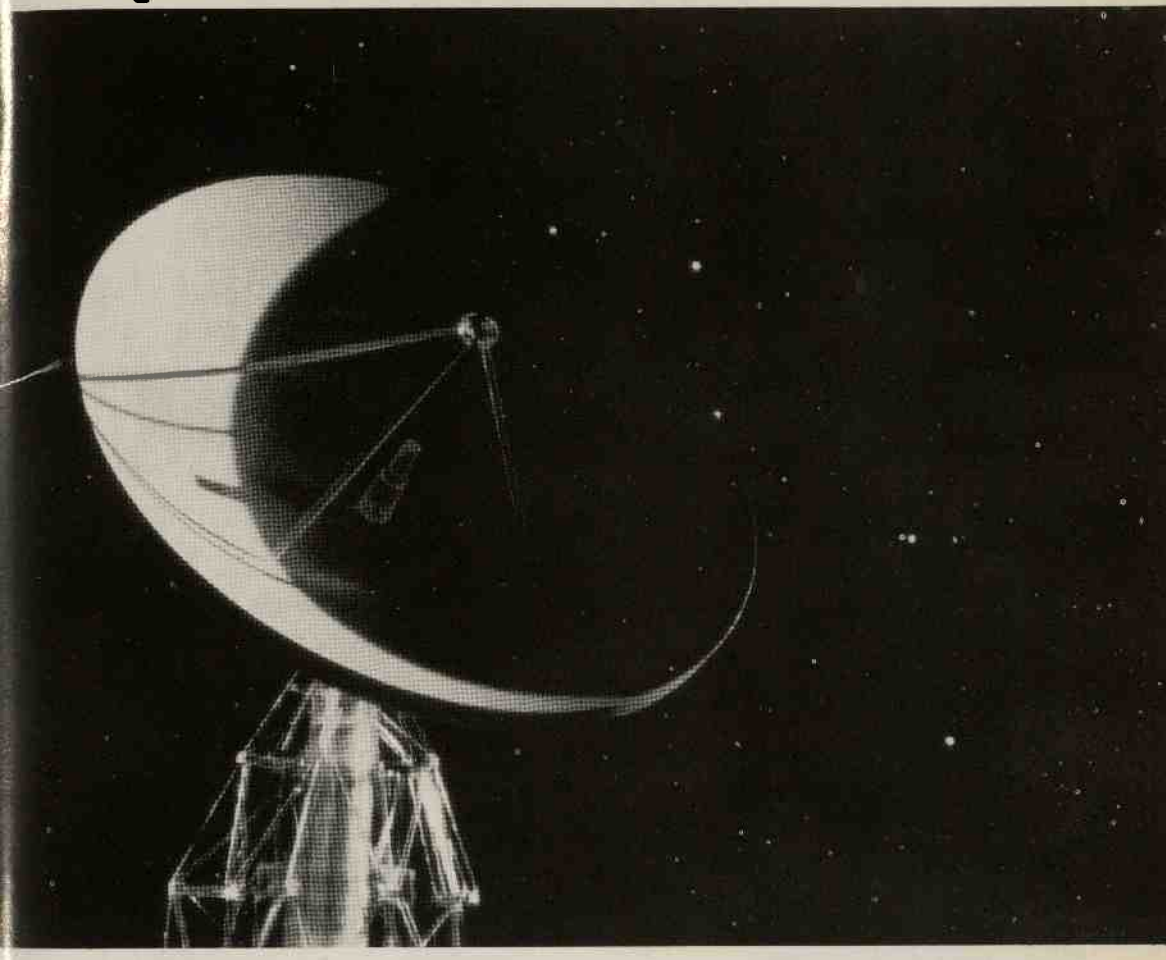

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